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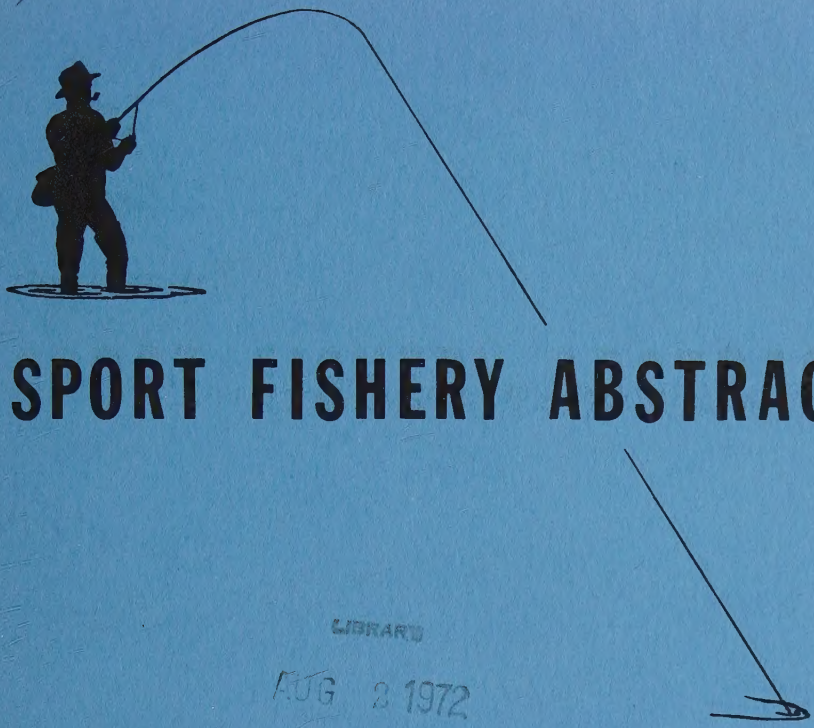

SPORT FISHERY ABSTRACTS

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Vol. 17, No. 2, 1972

Abstracts 14583 - 14932

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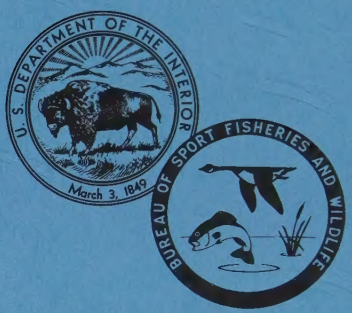

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Prepared in the Division of Fishery Research

Narragansett, Rhode Island

SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

One volume consisting of four numbers is issued each year. Each number contains separate Author and Subject indexes. The final number of each volume contains cumulative Author and Subject indexes and a list of publications screened.

Suggestions for improving the usefulness and scope of Sport Fishery Abstracts are solicited.

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14583. Walker, Charles R. (Bur. Sport Fish. & Wildl., Div. of Fish. Research, Dept. of the Interior, Washington, D. C.). 1971. THE TOXICOLOGICAL EFFECTS OF HERBICIDES AND WEED CONTROL ON FISH AND OTHER ORGANISMS IN THE AQUATIC ECOSYSTEM. Proc. Eur. Weed Res. Coun. 3rd int. Symp. Aquatic Weeds, pp. 119-127.

The use of aquatic herbicides is discussed and their impact on the freshwater environment illustrated by current research on 2, 4-D and endothal. Data on the toxicity of several herbicides to trout and invertebrates are summarized. (Auth. summ.)

14584. Snyder, Diane and Robert Reinert (U. S. Fish & Wildl. Serv., Great Lakes Fish. Lab., Ann Arbor, Michigan). 1971. RAPID SEPARATION OF POLYCHLORINATED BIPHENYLS FROM DDT AND ITS ANALOGUES ON SILICA GEL. Bull. of Environmental Contamination & Toxicology, 6(5): 385-390.

The described silica gel column rapidly and efficiently separates the two Aroclors tested from DDT and its analogues. Little prior preparation of the silica gel is needed. Because of the small size of the columns, numerous samples can be run simultaneously on individual columns in a small area. Separation is achieved in about 1 hour. Reproducibility of results and quantitative recoveries from samples were good.

14585. Kleinert, Stanton J. and Paul E. Degurse (Wis. Dept. of Natural Resources, Madison, Wisconsin). 1971. MERCURY LEVELS IN FISH FROM SELECTED WISCONSIN WATERS (A PRELIMINARY REPORT). Research Report 73, 16 p.; Selected Water Resources Abstracts, 4(16): p. 48, 1971.

Mercury determinations were made on fish filet samples from throughout Wisconsin and from Wisconsin's boundary waters of Lake Michigan, Green Bay, Lake Superior and the Mississippi River. All Wisconsin fish analyzed contained some mercury, with a range of 0.01 to 0.60 ppm, and average of 0.19 ppm. The highest mercury levels, averaging 0.80 ppm, and ranging from 0.06 to 4.62 ppm, occurred in fish taken from below paper mills and from below a mercury cell chlor-alkali plant. Different species vary in mercury content, and the larger fish often contain higher concentrations than do smaller fish of the same species taken from the same water. Walleye, sucker, redhorse, crappie and bullhead frequently showed higher mercury concentrations, while the panfishes showed lower concentrations. It is essential, therefore, that mercury levels in all important species in the fishery be determined before the potential pollution problem can be adequately assessed. -- LeGore.

14586. Duke, Thomas W. (Center for Estuarine and Menhaden Res., Bur. of Comm. Fish., Gulf Breeze, Florida). 1970. PESTICIDES AND POLYCHLORINATED BIPHENYLS IN ESTUARIES. Preprint, Ecological Problems in the Marine Environ., 1st National Biol. Congress, Amer. Inst. of Biol. Sciences and Federation of Amer. Societies for Experimental Biology, pp. 27-32; Selected Water Resources Abstracts, 4(16): p. 54, 1971.

A survey is presented on pesticides and polychlorinated biphenyls (PCBs) and their water pollution effects in estuaries. Sources of pesticides are agricultural area run-off, direct application for insect control, and municipal and industrial effluents, while sources of PCBs are industrial effluents. Various monitoring programs have located pesticide residues in fish and shellfish. Examples of effects of pesticides on ecosystems are given, such as regional declines of the speckled seatrout, the altering of capacity of phytoplankton to photosynthesize, mortality and abnormalities in crabs fed brine shrimp nauplii containing DDT, affects on embryonic development and larvae of filter-feeding mollusks, and death of sheepshead minnows. PCBs, including Aroclor 1260 and Aroclor 1254, have been located in bays and estuaries, in seals, porpoises, birds, fish, mussels, and shellfish. Bioassays conducted to determine effects of Aroclor 1254 on estuarine organisms show that the animals can concentrate the PCB, which can be toxic at concentrations in the ppb range. Realizing the potential hazard of PCBs, the Monsanto Chemical Company has recently announced that PCB sales would be limited to only those who could control disposal of the final product. A continual monitoring program of estuaries for toxic materials and effects is a necessity. -- McEntyre

14587. Kalal, L., and J. Napravnik (Prague Agric. Univ., Czechoslovakia). 1970. DESTRUCTIVE EFFECTS OF A LOW pH AND A HIGH CONTENT OF Fe-COMPOUNDS ON FISH. Zivocisna vyroba (Praha), 15(3): 225-232, 1970, in Czech, Eng. summ.; Selected Water Resources Abstracts, 4(20): p. 42, 1971.

In the upper course of the River Jizera, high water causes the pH to decrease even to 3.2 and the content of iron compounds to reach a value of 5.3 mg/c. This is a result of eluviations from spruce forests, of a granite base and of the flow-off from peat bogs. In the period of great fluctuation of water level and rate of flow from April to the middle of June, 1967, all species of released fish died within ten days. In June and July the water level, rate of flow, and consequently the pH and the content of iron reached a state of relative balance in which several experimental fish survived to the end of the experiment in August. A laboratory experiment demonstrated and corroborated field observations. It was also demonstrated that trout reared under favorable pH conditions (ca. 7.0) can hardly survive when acidity is instantly increased to pH 5.5. To achieve a successfull stocking of this area, the pure spruce stand must be gradually replaced with mixed forest, and resistant stocks of trout, reared in this region, should be used. -- LeGore.

14588. Baptist, J. P., D. E. Hoss, and C. W. Lewis (Radiobiological Lab., Bur. of Comm. Fish., Beaufort, North Carolina). 1970. RETENTION OF CHROMIUM-51, IRON-59, COBALT-60, ZINC-65, STRONTIUM-85, NIOBIUM-95, INDIUM-141m, AND IODINE-131 BY THE ATLANTIC CROAKER. Health Physics, Vol. 18, pp. 141-148; Selected Water Resources Abstracts 4(20): p. 44, 1971.

Biological half lives of radionuclides in fish were determined by injecting the radionuclides into the stomach and following the decline in radioactivity. The effect of temperature and salinity was studied. In a preliminary experiment with zinc-65, it was shown that the rate of loss in the radionuclide was the same for administration of the radionuclide in food, in the sea water, or by injection. Biological half lives for the various radionuclides ranged from 0.25 to 6.5 days for the short-lived component to 31 to 465 days for long-lived component. The relative hazard of the various radionuclides is discussed. -- Bopp

14589. Hansen, Edward A. (Central Forest Exp. Sta., Forest Serv (USDA), Cadillac, Michigan). 1971. SEDIMENT IN A MICHIGAN TROUT STREAM - ITS SOURCE, MOVEMENT, AND SOME EFFECTS ON FISH HABITAT. Forest Serv. Res. Paper NC-59, 14 p.; Selected Water Resources Abstracts 4(21): p. 17.

A sediment budget was constructed from 3 years of measurements on a pool and riffle stream. Total sediment load increased five times along a 26-mile length of stream; most sediment came from 204 eroding banks. Three-fourths of the total sediment load was sand size. The area of streambed covered with sand decreased downstream, indicating that the transporting capacity of the stream exceeded sediment supply. Complete streambank stabilization would reduce the sediment load by about half and probably result in streambed composition changes beneficial to trout. -- Knapp

14590. Armstrong, F. A. J., and J. F. Uthe (Freshwater Inst., Fish. Res. Bd. of Canada, Winnipeg, Manitoba, Canada). 1971. SEMI-AUTOMATED DETERMINATION OF MERCURY IN FISH TISSUE. In: 'Mercury in the Western Environment' workshop, Oregon State Univ., Portland, Feb. 25-26, 1971, 14 p.; Selected Water Resources Abstracts, 4(21): p. 35, 1971.

An automated method for determining mercury in fish, using flameless atomic spectrometry, has been developed in Winnipeg. Samples of 0.1-0.5g. tissue are digested with nitric and sulphuric acids at 58LC, then cleared with hydrogen peroxide and made up to 25 ml. Mercury is then reduced with hydroxylamine sulfate and the vapor equilibrated with air, using Technicon Auto Analyzer equipment. A mathematical relationship is used to calculate the performance of the system. Equilibration was very rapid and there was no alteration in sensitivity if the mixing coil was varied from one short to three long sections. The reagents used, in varying amounts, were potassium permanganate, acid wash, hydrogen peroxide, mercuric chloride (Standard A) and mercuric chloride (Standard B).

Special apparatus used were: Perkin-Elmer model 403 atomic absorption spectrophotometer, lamp, chart recorder, flow-through cuvette, analysis manifold, and shaking water bath. The steps of the procedure followed are described. Tables give the amount of mercury recovered from the fish samples and show that standard deviation increases with increasing mercury content. The method is rapid and sufficiently precise for most inspection and research purposes. -- Smith

14591. Snyder, George R. (NMFS, Seattle, Washington). 1970. THERMAL POLLUTION OF COLUMBIA RIVER MIGHT THREATEN SMELT. Comm. Fish. Review, 32(12): 58-64; Selected Water Resources Abstracts, 4(21): p. 64, 1971.

The National Marine Fisheries Service initiated an investigation to determine what effect temperature increases would have on aquatic animals and plants between Kalama and Longview, Washington. NMFS is cooperating closely with State and Federal agencies to investigate effects of thermal pollution on anadromous fish such as salmon, trout, sturgeon, shad, and smelt in the Columbia River. During winter 1968, adult smelt were examined to determine their thermal tolerance. Fish exposed 1 hour to 16 F suffered 50 percent mortality after a 32-hour holding period. Most females placed in water heated 7 F above river temperature failed to deposit eggs. Tests were conducted during 1969 to verify preliminary observations that adult smelt are intolerant to temperature increases. The general results of temperature tolerance studies verified earlier results. Smelt populations could face serious problems if thermal nuclear plants are allowed to discharge heated water into river. The problems could be compounded if water-temperature regulations and standards for the Columbia are based on tolerance limits of steelhead trout and salmon, the most valuable anadromous fish. -- McCann

14592. Marking, Leif L. (Bur. Sport Fish. & Wildl., La Crosse, Wisconsin). 1969. TOXICOLOGICAL ASSAYS WITH FISH. Bull. of the Wildlife Disease Association, Vol. 5, pp. 291-294; Selected Water Resources Abstracts, 4(21): p. 66, 1971.

The importance of and philosophy behind fish bioassay studies are reviewed, and the standard procedures used at the Bureau of Sport Fisheries and Wildlife, Fish Control Laboratories in La Crosse, Wisconsin, are described. Such aspects as numbers of test fish, feeding, water quality and water temperature are discussed. -- LeGore

14593. Fimreite, N., W. N. Holsworth, J. A. Keith, P. A. Pearce, and I. M. Gruchy (Dept. of Zool., Univ. of W. Ontario, London, Ontario, Canada). 1971. MERCURY IN FISH AND FISH-EATING BIRDS NEAR SITES OF INDUSTRIAL CONTAMINATION IN CANADA. The Canadian Field Naturalist, 85(3): 211-220.

Concentrations of mercury were determined in fish muscle, livers and eggs of fish-eating birds, and bivalve molluscs. Most of the material was collected near sites of industrial contamination: a mercury mine, chlor-alkali plants and pulp mills known to usé or have used mercury. Most sites showed substantial mercury contamination, especially downstream from the above sources. Mercury levels exceeding 0.5 ppm were found in practically all samples of freshwater fish. Individual walleye (Lake St. Clair), pumpkinseed (St. Clair River), and lake trout (Pinchi Lake) contained concentrations up to 5.01, 7.09, and 10.50 ppm of mercury respectively. Lower levels were found in marine fishes from coastal waters. A positive correlation was found between body weight and mercury concentration in most fish samples, and also between the trophic feeding level and mercury concentration in both fish and fish-eating birds. The highest mercury level in the livers of fish-eating birds was 17.40 ppm (Red-necked grebe). Four Common Tern eggs averaged 0.58 ppm and two Red-breasted Merganser eggs averaged 0.81 ppm. The mercury concentrations are discussed in terms of published data on hazard to human health and to reproduction in fish-eating birds. (Authors)

14594. Sarig, S. (Lab. for Research of Fish Diseases, Nir David, Israel). 1971. FISHERIES AND FISH CULTURE IN ISRAEL IN 1970. Bamidgeh, 23(3): 63-84.

14595. Kott, E. (Dept. of Biol., Waterloo Lutheran Univ., Waterloo, Ontario, Canada). 1971. CHARACTERISTICS OF PRE-SPAWNING AMERICAN BROOK LAMPREYS FROM BIG CREEK, ONTARIO. The Canadian Field Naturalist, 85(3): 235-240.

Mature adults of the American brook lamprey, Lampetra lamottei were collected in the spring from Big Creek, at Delhi, Ontario. The sex ratio was 2 males: 1 female. The average length of 100 individuals was 179 mm, showing no difference in the lengths of males and females. A significant difference in weight did exist, the average of 57 males being 9.7 g and 28 females, 10.9 g. Livers of females were significantly larger than those of males. The mean number of trunk myomeres for 15 specimens was 68.8. Mean fecundity and mean relative fecundity of 16 females were 3787 eggs per female and 357 eggs per gram body weight. The results were compared with data on Quebec populations of this species, which were composed of smaller individuals with a much higher relative fecundity. (Auth.)

14596. Yashouv, A. (Fish Culture Research Station, Dor, Israel). 1971. INTERACTION BETWEEN THE COMMON CARP (Cyprinus carpio) AND THE SILVER CARP (Hypophthalmichthys molitrix). Bamidgeh, 23(3): 85-92.

The common carp (Cyprinus carpio) and the silver carp (Hypophthalmichthys molitrix) are two fish species which differ markedly in their behavior. Interaction between these fish species was examined in fertilized ponds without additional feed. In a previous experiment on the monoculture of carp, it was found that the biomass of carp did not usually exceed 391 kg/ha (Yashouv, 1959). The results of polyculture of carp and silver carp show that the carp attained a biomass of 723 kg/ha. with individual fish averaging in weight in excess of 1 kg. The biomass of silver carp was 2420 kg/ha. the average weight of individual fish was 976 grams. These results show a positive interaction between the two fish species. The silver carp enabled the common carp to exceed their previous limit of 391 kg/ha. in monoculture. It was also found that the weight yield of silver carp, grown in polyculture with common carp, was higher than that of silver carp grown alone. We explain this positive (synergistic) interaction on the basis of increased food sources. Each of the fish species processes a food source; thus, making it available to the other. The fecal pellets of the silver carp, which are rich in partially digested phytoplankton, make this food source available to the common carp which otherwise could not utilize the phytoplankton. The common carp, by digging and ploughing the pond bottom, release into the water minute organic matter which is then strained out and utilized by the silver carp. This type of interaction of two organisms which live in entirely different ecological niches calls for a dynamic definition of the ecological niche. It is our opinion that the ecological niche represents a complex of interactions of the organism with its environment which together build a biotic entity. The biotic entity is an open system which interacts and influences other biotic systems. The interaction of the common carp with the silver carp is a good example of the relationship between two different biotic systems. (Auth.)

14597. Avtalion, R. R., A. Gorlin, E. Gutwirth, and E. Katz (Rapaport Lab. of Microbiology, Bar Ilan Univ., Ramat-Gan, Israel). 1971. AN APPROACH TO THE DETERMINATION OF BLOOD VOLUME IN FISH. Bamidgeh, 23(3): p. 100.

A new method for the evaluation of the blood volume, especially in aquatic animals, was developed in our laboratory. This method is based on red blood cell dilution which occurs in vivo, after bleeding large quantities of blood, (from 25% to 60% of the presumed total blood volume). This bleeding is found to be tolerated by the fish tested.

14598. Marek, M., and S. Sarig (Extension Service, Ministry of Agriculture, Israel). 1971. PRELIMINARY OBSERVATIONS OF SUPERINTENSIVE FISH CULTURE IN THE BEITH-SHEAN VALLEY IN 1969-1970. Bamidgeh, 23(3): p. 93.

14599. Larkin, P. A. (Inst. of Animal Res. Ecol. and Dept. of Zool, Univ. of Br. Columbia, Vancouver, British Columbia, Canada). 1971. SIMULATION STUDIES OF THE ADAMS RIVER SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 28(10): 1493-1502.

The pattern of abundance of sockeye salmon (Oncorhynchus nerka) of the Adams River since 1938 is: 1 year large or "dominant," 1 year small or "subdominant," and 2 years very small or "off." In recent years, the subdominant run has shown indications of becoming as large as the dominant. This pattern can be accounted for by a model system in which predation is not sufficient to influence the dominant run, but predators, benefited by the abundance of prey, remove such a large fraction in the 3 succeeding years that the pattern is retained. Buffering of predation by the dominant run accounts for the larger size of the subdominant. Patterns similar in form to those observed naturally since 1922 are produced over a narrow range of parameters, and suggest that the particular circumstances of the Adams run are necessary to the nature of the population fluctuation, but are not so particular that some other pattern could not have emerged with a different sequence of environmental conditions. Taking an array of results of a series of simulations suggests that the odds of developing the existing pattern were about 50:50, although the subdominant run would more commonly become dominant as well by 1951, rather than as late as the 1960's. The double dominance situation is stable in the model system. In the present circumstances it seems appropriate to explore the possible benefits of managing the fishery so as to enhance the growth in size of the subdominant run, and perhaps to consider predator-removal programs to enable development of large runs on all 4 years of the traditional cycle. (Auth.)

14600. Parker, Robert R. (Fish. Res. Bd. Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. SIZE SELECTIVE PREDATION AMONG JUVENILE SALMONID FISHES IN A BRITISH COLUMBIA INLET. J. Fish. Res. Bd. Canada, 28(10): 1503-1510.

Field observations suggest early sea mortality of pink (Oncorhynchus gorbuscha) and chum (O. keta) salmon fry is largely due to predation by juvenile coho (O. kisutch) salmon. A series of experiments demonstrates a strong bias toward the smaller individuals of the prey population. This results in an apparent growth rate 0.3-0.5% per day due to the biased mortality alone. With a high innate growth rate ($\bar{g} \sim 1.4\%$/day), the prey are shown to "outgrow" the predator ($\bar{g} \sim 0.7\%$/day), and hence become unavailable. Chums are shown to have an advantage over pinks through slightly earlier entry into the estuary and a larger initial size. The mechanism of selection used by the predator is not known from this study. (Auth.)

14601. Bell, Gordon R., Gary E. Hoskins, and W. Hodgkiss (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. ASPECTS OF THE CHARACTERIZATION, IDENTIFICATION, AND ECOLOGY OF THE BACTERIAL FLORA ASSOCIATED WITH THE SURFACE OF STREAM-INCUBATING PACIFIC SALMON (Oncorhynchus) EGGS. J. Fish. Res. Bd. Canada, 28(10): 1511-1525.

Stream-incubating eggs of chum (Oncorhynchus keta) and pink (O. gorbuscha) salmon usually appeared to have a characteristic bacterial flora associated with the radiate membrane or "capsule," Cytophaga spp. predominating over pseudomonads and other species. In comparison, populations on simulated egg surfaces (polyethylene spheres) consisted mostly of Pseudomonas spp. and Chromobacterium lividum, suggesting that the surface of the incubating egg is bacteriologically selective. The bacterial flora of dead eggs consisted mostly of Pseudomonas spp., whereas the ambient stream waters contained members of Acinetobacter, Aeromonas, Enterobacter, and two actinomycetes in addition to members of the genera found on eggs and "simulated eggs." Some characteristics of the bacteria found associated with the surface of the embryonated egg are examined in relation to egg survival. The embryonated egg is regarded as part of a dynamic ecosystem, coined the "oosphere," and it is suggested that egg mortality probably depends more upon the results of complex interactions between the egg, its microflora, and its ambient waters than upon the presence of an obligate pathogen. (Authors)

14602. Alderdice, D. F., and F. P. J. Velsen (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. SOME EFFECTS OF SALINITY AND TEMPERATURE ON EARLY DEVELOPMENT OF PACIFIC HERRING (Clupea pallasi). J. Fish. Res. Bd. Canada, 28(10): 1545-1562.

Pacific herring (Clupea pallasi) eggs were incubated in the laboratory at 13 different salinity-temperature combinations (ranges: 5-45‰ S, 4-14 C). Data were obtained on rate of development, larval length at hatching, percent total hatch, and percent viable hatch. Subsamples of larvae, held in their incubation media, provided data on posthatching survival and larval size at yolk sac absorption. Maximum percent viable hatch, larval size at hatching, and maximum survival to yolk sac absorption occurred in a trial at 16.41‰ S, 6.85 C. Optimum conditions were calculated by response surface analysis - maximum total hatch: 12.01‰ S, 6.46 C; maximum viable hatch: 16.98‰ S, 8.33 C; maximum length of newly hatched larvae: 20.00‰ S, 5.54 C. Maximum percent viable hatch of largest larvae in the shortest incubation period is estimated to occur at or near 16.98‰ S, 8.7 C. Abnormalities of the lower jaw were present in larvae from eggs incubated at temperatures of 4.0 and 4.71 C. Pacific herring eggs are considered euryhaline and stenothermal. A comparison of laboratory and field observations suggests that occurrence and abundance of herring is related to the availability and extent of spawning salinities between 8 and 28‰. Moreover, catch statistics suggest that population abundance in North American waters is associated with spawning temperatures of 5-9 C, abundance is limited by temperatures of 9-10 C, and the maximum temperature for spawning is about 10 C. From the current study, survival of viable larvae to yolk sac absorption would place the lower limit of thermal tolerance of Pacific herring eggs between 4 and 5 C. (Authors)

14603. Kabata, Z. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. FOUR BOMOLOCHIDAE (COPEPODA) FROM FISHES OF BRITISH COLUMBIA. J. Fish. Res. Bd. Canada, 28(10): 1563-1572.

Holobomolochus venustus and Holobomolochus occultus, two new species of Bomolochidae (Copepoda: Cyclopoida) are recorded from fishes of British Columbia, described, and illustrated. Holobomolochus spinulus is found for the first time in the Canadian waters, and two new hosts (Damalichthys vacca and Gasterosteus aculeatus) are recorded for Bomolochus cuneatus. (Auth.)

14604. Allen, K. Radway (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. RELATION BETWEEN PRODUCTION AND BIOMASS. J. Fish. Res. Bd. Canada, 28(10): 1573-1581.

A series of mathematical models of cohorts in animal populations representing various combinations of several different simple growth and mortality functions is examined to investigate the ratio between mean biomass and production over unit time, and to compare this ratio with the mean age and mean life span of the animals in the cohort. For any cohort, the ratio of production per unit time to mean biomass is equal to the ratio of total production by the cohort to its total biomass integral by time. For populations consisting of a number of simultaneous, successive, or overlapping cohorts, the ratio of production per unit time to mean biomass is equal to the mean of the ratios for the individual cohorts weighted by the mean biomasses of the cohorts. If the cohorts are identical, the population ratio is the same as the cohort ratio and problems arising from the presence of more than one cohort may be ignored. Formulations for the total production per cohort, biomass integral, and, where they can be simplified, their ratios, are given. Comparison with mean age and mean life span shows that for constant exponential mortality, mean age and mean life span are both equal to the reciprocal of the production-biomass ratio. For other mortality functions, if growth in weight is linear, the production-biomass ratio equals the reciprocal of the mean age. For other models there is no simple relation. In general, mean age appears a better approximation than mean life span to the reciprocal of the production-biomass ratio. These methods are applied, as an example, to Antarctic krill, using a model having linear growth in length and four periods with different exponential mortality rates. For this model, annual production is 1.8 times the mean biomass

so that assumption of equality leads to an underestimate of production. Mean age and mean life span are 0.21 and 0.037 years respectively. Thus, use of either of these as an approximation, and particularly mean life span, leads to severe overestimation of annual production. (Auth.)

14605. Calaprice, J. R., H. M. McSheffrey, and L. A. Lapi (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. RADIOISOTOPE X-RAY FLUORESCENCE SPECTROMETRY IN AQUATIC BIOLOGY: A REVIEW. J. Fish. Res. Bd. Canada, 28(10): 1583-1594.

X-ray fluorescence spectrometry is described as an efficient means of carrying out non-destructive qualitative and quantitative chemical analyses of inorganic substances. A brief review is presented on the way in which this methodology was developed to recognize marked individuals and its application towards determining the geographic origin of organisms using multivariate analysis of the trace element composition of untagged animals. In addition, the results of experiments in whcih 34 species of invertebrates were compared and different parts of the same organisms irradiated, demonstrated that organisms may possess characteristic elemental compositions that are species specific. Multiple discriminant function analysis of the data showed that species may be classified on the basis of their chemical composition with few errors. Winter and summer growth of molluscan shells were distinguishable by the same method of elemental analysis, and a method for determining the age of organisms is given. Stepwise discriminant function analysis of the groups of elemental standards demonstrate that it is possible to isolate the most significant differences found between the groups compared by this methodology. The importance of these findings to studies in biogeochemistry, physiology, and pollution are briefly reviewed. X-ray fluorescence spectrometry is considered to be one of a number of related forms of data acquisition systems, each with broad applications. (Authors)

14606. Moravec, F., and Hisao P. Arai (Inst. of Parasitology, Czechoslovak Acad. of Sciences, Prague, Czechoslovakia). 1971. THE NORTH AND CENTRAL AMERICAN SPECIES OF Rhabdochona Railliet 1916 (NEMATODA: RHABDOCHIDAE) OF FISHES, INCLUDING Rhabdochona canadensis sp. nov. J. Fish. Res. Bd. Canada, 28(10): 1645-1662.

The systematics of the representatives of the genus Rhabdochona, parasitic in fishes of North and Central America, is revised. Rhabdochona cascadilla Wigdor 1918, R. kidderi Pearse 1936, R. decaturensis Gustafson 1949, R. cotti Gustafson 1949, R. ovifilamenta Weller 1938, R. milleri Choquette 1951, and R. canadensis sp. nov. are considered as the valid species of this region. The first six species are redescribed and illustrated. The new species, R. canadensis, is described from the cyprinids Hybopsis gracilis (flathead chub; type host), H. plumbea (lake chub), and Rhinichthys cataractae (longnose dace) of Alberta; the latter form is characterized largely by the presence of one or two long filaments at each pole of the eggs, by 14 teeth in the prostom, by the presence of the cuticular spike at the tip of the tail, and by the character of the spicules. The species R. pellucida Gustafson 1949 is regarded as a synonym of R. cascadilla Gustafson 1949, and R. laurentiana Lyster 1940 as a synonym of R. ovifilamenta Weller 1938. Rhabdochona serrata (Wright 1879) Ko and Anderson 1969 is transferred to the genus Cystidicola as species inquirenda. The hosts and geographical distribution of the current members of the genus are reviewed. The paper is supplemented by a key for the identification of the species parasitic in fishes of North and Central America. (Authors)

14607. Laurence, Geoffrey C. (Dept. of Conserv., Cornell Univ., Ithaca, New York). 1971. DIGESTION RATE OF LARVAL LARGEMOUTH BASS. N. Y. Fish and Game Journal, 18(1): 52-56.

The relationship between digestion rate and temperature for active and non-active larval largemouth bass was examined for the range from 17° to 23° C. The ratio of active to non-active digestion was approximately 2 to 1 for all temperatures. The rates of digestion decreased linearly as temperature increased, i.e., 10.4 minutes per degree of temperature rise for active digestion and 18.1 minutes per degree of temperature rise for non-active digestion. (Auth.)

14608. Tarr, H. L. A., and Linda Gardner (Fish. Res. Bd. of Canada, Vancouver Lab., Vancouver, British Columbia, Canada). 1971. RIBONUCLEOTIDE REDUCTASE IN IMMATURE TESTES OF SALMON. J. Fish. Res. Bd. Canada, 28(10): 1603-1608.

When cell-free extracts obtained by ultracentrifugation of homogenates of immature salmon testes were incubated with radioactive ribonucleoside di- or triphosphates, the corresponding deoxyribonucleosides were isolated from the reaction mixtures. The specific activities of the crude enzyme extracts were between 15.8 and 54 picomoles of deoxyribonucleoside formed per milligram of protein per hour at 25 C. All attempts to purify the enzyme, which lost activity quite rapidly at 0 C, were unsuccessful. Acid hydrolysis of guanosine deoxyribosides of constant specific radioactivity formed by enzymic reduction of tritiated guanosine triphosphate (GTP) or guanosine diphosphate (GDP) yielded radioactive guanosine of similar specific radioactivity. The crude nature of the preparation, which possessed phosphoribokinase and phosphatase activities, made it impossible to decide whether nucleotide reduction occurred at the mono-, di-, or triphosphate level. Evidence was obtained that allosteric effectors are required for ribonucleotide reduction, as with mammalian and bacterial ribonucleoside diphosphate reductase. The enzyme required dithiothreitol and iron, was strongly stimulated by ethylenediaminetetraacetate (EDTA) and was inhibited by dADP. (Authors)

14609. Davis, John C. (Dept. of Zool., Univ. of British Columbia, Vancouver, British Columbia, Canada). 1971. CIRCULATORY AND VENTILATORY RESPONSES OF RAINBOW TROUT (Salmo gairdneri) TO ARTIFICIAL MANIPULATION OF GILL SURFACE AREA. J. Fish. Res. Bd. Canada, 28(10): 1609-1614.

Reductions in surface area of the gill were artificially produced by ligating various gill arches and occluding their blood supply. Rainbow trout (Salmo gairdneri) responded to a 40-57% reduction in gill area, by increasing cardiac output and ventilation volume, and probably by redistributing blood within the remaining functional gill area. Fish with blood flow to gill arches one and three only, could maintain arterial PO_2 at 90-100 mm Hg, whereas, in those with blood flow to arches three and four only, arterial PO_2 fell to around 40 mm Hg. The presence of a chemoreceptor site for the regulation of arterial PO_2 associated with the efferent blood vessels of arch number one is discussed. Such a receptor may be located in the pseudobranch or in the portion of the brain supplied with arterial blood from the first gill arch. (Auth.)

14610. Evelyn, T. P. T. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. AN ABERRANT STRAIN OF THE BACTERIAL FISH PATHOGEN Aeromonas salmonicida ISOLATED FROM A MARINE HOST, THE SABLEFISH (Anoplopoma fimbria), AND FROM TWO SPECIES OF CULTURED PACIFIC SALMON. J. Fish. Res. Bd. Canada, 28(10): 1629-1634.

Biochemically unique strains of the causative bacterium (Aeromonas salmonicida) of furunculosis in fish are described. The strains were first isolated from a marine host, the sablefish, Anoplopoma fimbria, and later, from sockeye (Oncorhynchus keta) salmon. The strains were essentially identical, and although always isolated from diseased fish cultured in sea or brackish water, they behaved like typical freshwater bacteria. The outbreaks of furunculosis in local fish-culture facilities were rare events that are thought to have resulted from import of the pathogen in wild carrier fish. In the case of the sablefish that was captured at sea shortly before its death, the infection appears to represent the first instance of spontaneous furunculosis in a marine fish. (Auth.)

14611. Brett, J. R. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. GROWTH RESPONSES OF YOUNG SOCKEYE SALMON (Oncorhynchus nerka) TO DIFFERENT DIETS AND PLANES OF NUTRITION. J. Fish. Res. Bd. Canada, 28(10): 1635-1643.

The growth rate and food conversion efficiency of yearling sockeye salmon (Oncorhynchus nerka) (26 $\pm$ 2 g) was determined for Halver's test diet, Clark's chinook mash, Abernathy pellets, frozen marine zooplankton, and sockeye mash, using a number of planes of nutrition. The maximum growth rates at 15 C varied

from 3.1% dry body wt/day (Halver's) to 1.5%/day (marine zooplankton) with corresponding gross conversion efficiencies of 48 and 10%. Maintenance rations were determined, mostly by extrapolation, and used to evaluate the net conversion efficiency for each diet. The highest was 74% net conversion on Halver's test diet. Although major differences in growth response existed between the five diets, it was concluded that the various moist diets based on fish meal, used in these and earlier experiments, were not significantly different from each other when on the same plane of nutrition. (Auth.)

14612. Ricker, W. E. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. DERZHAVIN'S BIOSTATISTICAL METHOD OF POPULATION ANALYSIS. J. Fish. Res. Bd. Canada, 28(10): 1666-1672.

Derzhavin's biostatistical method, as modified by Boiko and others, uses annual age censuses and catch statistics to compute the utilized stock (virtual population), V_i, of year-class i in a given year as the sum of all members of that year-class that are caught in the current and future years. The sum of V_i values for all year-classes present in a given year is the total utilized population, V. The biostatistical rate of exploitation for individual ages (C_i/V_i), or of the stock as a whole (C/V), is the catch divided by the utilized stock. If ages of the fish in the stock are read too low, values of C_i/V_i and C/V are too large. For fully recruited fish C_i/V_i is an unbiased estimate of the total mortality rate, A, but for incompletely recruited ages, it differs progressively from A and has no simple interpretation. Variations in abundance of successive year-classes do not affect the interpretation of C_i/V_i or C/V for fully recruited ages, but changes in rate of fishing, F, are disturbing. When incompletely recruited ages are included in a biostatistical computation (as has usually been done), C/V does not have any precise interpretation in terms of population parameters. In addition, variations in year-class strength affect the value of C/V even when F does not change from year to year. It is possible to use C/V for the whole catch as an "arbitrary" index that reflects the direction and magnitude of changes in intensity of fishing over a period of years. However, even for this purpose the same minimum age must be used in all years. When data for a long series of years are available, the utilized year-class strength (ΣC_i) of the year-class hatched in year i can be compared with the total utilized stock (or the utilized mature stock) present in year i, in order to examine parent-progeny relations. Incompletely recruited as well as fully recruited ages can be used in this comparison, but adjustments are necessary if mortality rate (natural or fishing) changes from year to year. The biostatistical method does not provide separate estimates of natural and fishing mortality rates. If the possibility of a moderate or large natural mortality is disregarded, serious errors of interpretation may result. (Auth.)

14613. Briggs, Philip T., and Joel S. O'Connor (N. Y. State Dept. of Environ. Conservation, New York). 1971. COMPARISON OF SHORE-ZONE FISHES OVER NATURALLY VEGETATED AND SAND-FILLED BOTTOMS IN GREAT SOUTH BAY. New York Fish and Game Journal, 18(1): 15-41.

Between May 1967 and November 1968, a total of 310 seine hauls were made at paired stations, representing naturally vegetated bottoms and sand-filled bottoms, at three sites in Great South Bay on Long Island. Collected fish were counted, measured and weighed to compare species composition over the two types of bottom. All sand-filled bottoms were created by the deposition of spoil from dredging operations. Most of the non-temporal variability in species composition could be attributed to differences between the bottom types. Of 40 fish species recorded, 23 clearly preferred one bottom type over the other. Most species preferred the naturally vegetated bottoms. (Authors)

14614. U. S. Department of the Interior, Bureau of Commercial Fisheries. (Washington, D. C.). 1971. REPORT OF THE BUREAU OF COMMERCIAL FISHERIES FOR THE CALENDAR YEAR 1969. U. S. Dept. of the Interior, Bur. of Comm. Fisheries, 135 p.

14615. Nicholson, B. L. (Dept. of Microbiology, Coll. of Life Sciences and Agriculture, Univ. of Maine, Orono, Maine). 1971. EFFECT OF ACTINOMYCIN D ON THE MULTIPLICATION OF THE INFECTIOUS PANCREATIC NECROSIS VIRUS OF TROUT. Experientia, 27(11): 1362-1363. In English with French summary translated by Robert M. Howland.

The growth of the IPN virus in trout cell cultures was inhibited by more than 99% by actinomycin D, at all concentrations tested. The sensitive reaction to the actinomycin takes place in the early phases of the infectious process.

14616. Peters, H. M. (Zoophysiologisches Institut der Universität, Abteilung für Physiologische Verhaltensforschung, Beim Kupferhammer 8, D-74 Tübingen, Germany). 1971. EVIDENCE OF DIRECT NERVOUS CONNECTIONS BETWEEN THE NEUROMASTS OF THE LATERAL LINE SYSTEM OF FISHES. Experientia, 27(11): 1292-1293. In English with German summary translated by Robert M. Howland.

Histochemical confirmation is made on Tilapia (Cichlidae, Teleostei) of the concept expressed in 1880 by Solger, which later fell into oblivion, that the connecting strands between the neuromasts in the lateral canals in teleosts are nerve bundles similar to those of the vegetative nervous system.

14617. Kozlowski, Feliks. 1971. INVESTIGATIONS ON THE USE OF FURAZOLIDONE FOR CONTROL OF BACTERIAL HEMORRHAGIC SEPTICEMIA OF CARP. (Badania nad zastosowaniem Furazolidonu w leczeniu posocznicy karpi). Medycyna Weterynaryjna, 27(8): 460-464. Polish with Russian and English summaries.

Nitrofurans were introduced to treatment of fish disease by Gutsell in 1947. Since that time they are being used at an increasing rate all over the world. Bacterial hemorrhagic septicemia is caused by Aeromonas liquefaciens with possible viral complications. Nevertheless antibacterial drugs are very effective in its control. Author tested furazolidone in dosages from 2.5 to 50 mg of the drug per kilogram of carp per day, administered orally with food for 5 days. Satisfactory results were obtained with the dosage from 10 to 20 milligrams. Acute toxicity was caused by a single oral dosage of 400 to 500 mg per kilogram of fish. The therapeutic level of the drug in fish serum is maintained only for 24 hours following termination of treatment. Experiments were performed at the temperatures of 18, 25, and 27°C. -- S. F. Snieszko

14618. Bache, Carl, Colin McKone, and Donald J. Lisk (Pesticide Residue Lab., Cornell Univ., Ithaca, New York). 1971. RAPID DETERMINATION OF MERCURY IN FISH. Journal of the Assoc. of Official Analytical Chemists, 54(3): 741-743; Comm. Fish. Abstr., 24(12): p. 17.

A convenient combustion-colorimetric method is described that is sufficiently sensitive to detect mercury residues in fish at the FDA-tolerated 0.5 p.p.m. limit. It involves modifications of the Schöniger method (which is satisfactory for fruits, vegetables, and other foods containing little fat or oil) to permit combustion of fish containing high concentrations of fat and oil. Those laboratories that do not have the equipment to analyze for mercury by the Hatch and Ott method (1968) of flameless atomic absorption spectrometry will find the proposed method particularly useful.

14619. Scholl, Russell L. (Ohio Dept. of Natural Resources, Div. of Wildl., Sandusky, Ohio). 1971. AN ICHTHYOLOGICAL GIRTHOMETER FOR RAPID FIELD USE. Ohio Fish and Wildlife Report 1, 3 p., illus.

There has long been a need for a girth measuring device whose accuracy and durability are not affected by excessive amounts of water or fish slime. Such a device was constructed utilizing some brass tubing, a small metal table, nylon line, and a wooden base. The device proved to be a substantial and rapid girth measurer. Speed of measurement could be increased if two instruments were constructed, one for small girth ranges and one for large girth ranges. (Auth.)

14620. Bache, Carl A., and Donald J. Lisk (Pesticide Residue Lab., Dept. of Entomol., Cornell Univ., Ithaca, New York). 1971. GAS CHROMATOGRAPHIC DETERMINATION OF ORGANIC MERCURY COMPOUNDS BY EMISSION SPECTROMETRY IN A HELIUM PLASMA. APPLICATION TO THE ANALYSIS OF METHYLMERCURIC SALTS IN FISH. Analytical Chemistry, 43(7): 950-952; Comm. Fish. Abstr., 24(12): p. 17.

In 1965, McCormack et al. reported development of a method whereby organic compounds containing sulfur, phosphorus, and halogens could be detected chromatographically by emission spectrometry in a microwave-powered inert-gas plasma. In investigations prior to the previous one, the present authors applied the method to analyses of pesticides in agricultural samples. In the present one, they extend the method to an analysis of methylmercuric chloride in Lake Erie coho salmon. The instrument used was identical to the one they described in the report (1967) of the earlier investigation on pesticides in agricultural samples. However, a tuning device was used with the tapered matching cavity and 35.7 watts rather than 51 watts was applied to the plasma. The monochrometer wavelength was adjusted to isolate the 2537 Å atomic mercury line, and a Varian Aerograph (Model 705) gas chromatograph equipped with a ^{63}Ni electron affinity detector was used to confirm the analytical results. When no methylmercuric chloride was added to duplicate 10-g. samples of coho, the electron affinity detector and the emission spectrometric detector gave identical results (0.20 and 0.18 p.p.m.); when 0.17 p.p.m. methylmercuric chloride was added to the samples, average recovery was 0.32 and 0.295 p.p.m. for the two detectors, respectively. Average percent recovery was 71 and 62, respectively. These values agree with those of Westoo, whose method of analysis (reported in Acta Chem. Scand. 20, 2131 (1966) and 21, 1790 (1967) was used during the investigation. He found that, due to unfavorable partition coefficients, about 30% of the methylmercuric salts is lost during the procedure. The emission detector discussed here is the only selective gas chromatographic detector the authors are aware of for analyzing mercury compounds. They estimate that its sensitivity for methylmercuric chloride in fish is from 0.05 to 0.1 p.p.m., depending on the control value. The essential lack of hydrocarbon emission in the 2537 Å region probably accounts for the selectivity. The selectivity ratio of the 2537 Å atomic emission line for mercury when methylmercuric chloride is compared to eicosane is at least 10,000:1; the detector responds linearly from 0.1 to at least 100 ng. of injected methylmercuric chloride. Although low-pressure helium plasma was used during these analyses, argon plasma can be used equally well for mercury analysis.

14621. Cullen, M. C., and E. T. McGuinness (Dept. of Chem., Seton Hall Univ., South Orange, New Jersey). 1971. RADIOCHROMATOGRAPHIC ASSAY FOR THIOL GROUPS OF SOLUBLE PROTEINS USING MERCURY-203 LABELED METHYLMERCURY. Analytical Biochemistry, 42(2): 455-469; Comm. Fish. Abstr., 24(12): p. 17.

Incidents of alkyl mercury poisoning have occurred either from the use of organomercurials as seed dressing and fungicides or from the anaerobic generation of methylmercury by methanogenic microorganisms in the bottom sediments of lakes and rivers. (These aquatic organisms convert the inorganic mercury discharged by pulp, paper, and chlorine industries to environment-contaminating methylmercury.) Thus organomercurial poisoning can arise from either the aquatic or the terrestrial food chain. In animal foodstuffs, methylmercury is probably largely attached to thiol groups. In view of the reported extent of alkyl mercury poisoning, then, a sensitive method for thiol group assay becomes increasingly important. The authors have developed an automated method for continuously monitoring $^{203}Hg(II)$, $[^{203}Hg]CH_3Hg^+$, and [^{203}Hg]methylmercuri-labeled proteins in an aqueous system. $[^{203}Hg]CH_3HgNO_3$ is used to react with the protein or thiol-bearing group; excess reagent is separated from the labeled thiol-containing material. Then, at the same time analysis is carried out by placing the reaction mixture on a gel permeation column and continuously monitoring the β radiation of the effluent in an anthracene-packed flow cell mounted in a liquid scintillation counter (or the γ radiation of the nuclide in a sodium-iodide well-type scintillation counter). The cationic surfactant Hyamine 2389 causes either no

retention or a marked attenuation of mercury or methylmercury and methylmercury-labeled proteins on anthracene. Using ribonuclease and bovine serum albumin as the test proteins, the authors were able to rapidly and reproducibly assay between 10^{-6} and 10^{-9} mole of protein when the specific activity of the working mercurial solution was held to between 13 and 35 μCi/mmole. They consider the method to be sufficiently sensitive to serve as a basis for the radiochemical determination of Hg(II) and CH_3Hg^+ in environmental water and in foodstuffs.

14622. Bellman, Sander W., and Thomas L. Barry (Food and Drug Admn., 850 Third Ave., Brooklyn, New York). 1971. COMBINED GAS CHROMATOGRAPHY-MASS SPECTROMETRY OF MULTIPLE CHLORINATED PESTICIDE RESIDUES IN FOODS. Journal of the Assoc. of Official Analytical Chemists, 54(3): 499-506; Comm. Fish. Abstr., 24(12): p. 17.

Described is a system for rapidly identifying multiple chlorinated pesticide residues in foods and for positively distinguishing and removing those polychlorinated biphenyls (PCB) that tend to interfere with the analysis. Using a mass spectrometer (MS) coupled directly to a gas-liquid chromatograph (GLC), the authors identified p,p'-DDE in cheese and several isomers of HCH(1, 2, 3, 4, 5, 6-hexachlorocyclohexane) in cocoa beans and frog legs, and they demonstrated the removal of PCB components from under the p,p'-DDE and p,p'-DDT peaks in the chromatograms of fresh and smoked chub. In demonstrating the technique, they show that the 6% ether eluates of some products prepared by conventional FDA "Pesticide Analytical Manual" procedures for fatty and nonfatty foods are suitable for direct GLC-MS analysis, without further cleanup. However, further cleanup is necessary for the 15% ether eluates prepared by the fatty food procedure. They were able to obtain identifiable mass spectra on standard p,p'-DDE amounting to as little as 0.04 μg., but in actual injected samples, such spectra required 0.3 μg. p,p'-DDE, equivalent to 0.1 p.p.m. in fatty foods.

14623. Fitzgerald, George P. (Water Resources Center, Univ. of Wis., Madison, Wisconsin). 1971. ALGICIDES. Report on Eutrophication Information Program, Lit. Review-2W71-06189, OWRR-W-117-WIS(3), 54 p. Available from the National Tech. Information Serv., Operations Div., Springfield, Va., Order No. PB-198 130, PC$3.00; Government Research Announcements 71(10): 43; Comm. Fish. Abstr., 24(12): p. 24.

An evaluation of algicides--what they are, their usage, how they are tested, their efficiency, and methods of application--is presented. Detailed are appropriate test organisms, culture and test media, the importance of algicidal versus algestatic effects, and effective chemical concentrations required to achieve potential toxicity. Characteristics of an algal problem, together with its environment, influence the methodology of application processes as well as detoxification, resistance, and synergism. Algal problems of water supply reservoirs and recreational lakes, fish ponds, swimming pools, and cooling towers are specifically discussed with suggestions for effective application of toxicants for their control.

14624. Bach, R., et al. 1971. TANK TROUT AS CARRIERS OF Clostridium botulinum AND THE CAUSE OF BOTULISM. 3. DETECTION OF Clostridium botulinum TYPE E IN A TANK FISH FARM AND IN FRESH AND SMOKED TROUT FROM VARIOUS SOURCES. Arch. Lebensmittelhyg. 22(5): 107-112 (In German); BFMIRA Abstracts, 24(8): 544, Abstr. No. 2646; Comm. Fish. Abstr., 25(3): p. 5

Clostridium botulinum type E was found in the gut contents of trout, in the silts of the tanks and in commercial smoked trout fillets. In experiments on the influence of vacuum packing and storage temperature on growth and toxin formation in smoked trout by Cl. botulinum no conclusions could be reached. Marked spoilage occurred in trout fillets stored at 10° C, 20° C and 30° C after 10 days. A storage temperature of 5° C reduced spoilage but did not prevent toxin formation.

14625. Gee, Phyllis A., and Keith L. Moore (Dept. of Anatomy, Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1970. CHROMATIN PATTERNS IN FISHES WITH EMPHASIS ON SEXUAL DIMORPHISM. Can. J. Zool., 48(6): 1283-1286.

Twelve species of fish were investigated to determine whether sexual dimorphism occurs in the nuclei of their tissues as has been described for mammals. Feulgen-positive masses were present in nuclei of most tissues; some were similar in size, shape, and location to sex chromatin found in human buccal smears of the female. Although in Salmo gairdneri (rainbow trout) incidences of intranuclear chromatin masses in tissues of males were significantly higher than those of females, it was impossible to detect microscopically a nuclear sex difference in any of the species examined. (Authors)

14626. Deutsch, Maurice, and Vibeke E. Engelbert (Ramsay Wright Zool. Lab., Univ. of Toronto, Toronto, Ontario, Canada). 1970. ERYTHROPOIESIS THROUGH CLONE CELL FORMATION IN PERIPHERAL BLOOD OF THE WHITE SUCKER, Catostomus commersoni, STUDIED AFTER LABELING WITH ^{3}H-THYMIDINE FOR VARIOUS EXPOSURE INTERVALS. Can. J. Zool., 48(6): 1241-1250.

A process of erythropoiesis, in which new red blood cells (clone cells) originate from preexisting young mature red blood cells as sac-like protuberations or nuclear blebs in the peripheral blood of the white sucker, is demonstrated. These protuberations, called the clone cells, which became labeled on exposure to ^{3}H-thymidine and which stain positively for deoxyribonucleic acid (DNA), eventually condense, producing margins of cytoplasm which surround discrete nuclei. This cytoplasm is shown to contain ribonucleic acid (RNA) and, later, the appearance of hemoglobin can be demonstrated with the acridine orange fluorescence method. Clone cells make up about 10% of the cells of the peripheral blood of the white sucker. Both clone cells and their mother cells became labeled on exposure to ^{3}H-thymidine: from 25% to 38% of the young mature red blood cells had mean grain counts which varied from 18.2 to 21.1 grains per cell; from 13.1% to 18.3% of the stage II clone cells gave mean grain counts of 235 to 301 grains per cell. Greatest uptake of ^{3}H-thymidine was observed about the 48th h and the fifth day. This investigation shows that close cell formation, in the peripheral blood of teleost fish is identical with the one demonstrated earlier for birds and for reptiles. This is the first time, however, that grain counts of mother nuclei and clone cell nuclei have been reported and compared to one another. (Authors)

14627. Beamish, F. W. H. (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1970. OXYGEN CONSUMPTION OF LARGEMOUTH BASS, Micropterus salmoides, IN RELATION TO SWIMMING SPEED AND TEMPERATURE. Can. J. Zool., 48(6): 1221-1228.

Oxygen consumption was determined for largemouth bass, Micropterus salmoides, of various sizes in relation to sustained swimming speeds. The logarithm of oxygen consumption for a given swimming speed and temperature increased linearly with the logarithm of weight. Slopes of regressions were considerably less than unity. In general, slopes fof different swimming speeds at a given temperature did not differ significantly. The relation between logarithm of oxygen consumption and swimming speed is expressed as a series of parallel, linear regressions for the temperatures followed. For a given swimming speed, oxygen consumption increased with temperature from 10 to 34 C, the highest temperature followed. Active oxygen consumption increased linearly with weight when expressed on a logarithmic grid. At each temperature the slope of the regression approached unity. The logarithm of standard oxygen consumption increased linearly with temperature from 10 to 34 C. The logarithm of maximum sustained swimming speed increased linearly with total length at each temperature. For a given total length, maximum sustained swimming speed increased from 10 to 30 C. Between 30 and 34 C maximum speed decreased. (Auth.)

14628. Larsen, C. M. (Inland Fish. Resources Branch, Fish. Resources Div., Dept. of Fish., FAO of the United Nations, Rome, Italy). 1971. A WORLD LIST OF FISHERY LIMNOLOGISTS. FAO Fisheries Technical Paper No. 108, 43 p.

14629. Rausch, R. L., and D. K. Hilliard (Arctic Health Research Center, U. S. Dept. of Health, Education, and Welfare, College, Alaska). 1970. STUDIES ON THE HELMINTH FAUNA OF ALASKA. XLIX. THE OCCURRENCE OF Diphyllobothrium latum (Linnaeus, 1758) (CESTODA: DIPHYLLOBOTHRIIDAE) IN ALASKA, WITH NOTES ON OTHER SPECIES. Can. J. Zool., 48(6): 1201-1219.

Cestodes representing six species of the genus Diphyllobothrium Cobbold, 1858, were collected from naturally infected terrestrial mammals in Alaska during the period 1949-1970. Additional specimens were reared in experimentally infected animals. Of the species identified, viz., D. latum (Linnaeus, 1758), D. dendriticum (Nitzsch, 1824), D. lanceolatum (Krabbe, 1865), D. ursi Rausch, 1954, D. dalliae Rausch, 1956, and D. alascense Rausch and Williamson, 1958, all but D. alascense were obtained from man after treatment with quinacrine. D. latum occurred most commonly in man; D. ursi is reported for the first time from this host, and D. lanceolatum in man was represented by a single plerocercoid. D. lanceolatum, a characteristic parasite of phocids, was found also in dogs; D. alascense was obtained only from dogs. In man, rates of infection by Diphyllobothrium spp. were highest in the delta region of the Kuskokwim and Yukon Rivers, western Alaska. Included is a description of D. latum and a discussion of morphologic variation, based upon specimens from Alaska, with a consideration of differential characters of the other species reported. Some biological characteristics of these cestodes are briefly discussed. (Authors)

14630. Byrne, John E. (Dept. of Zool., Univ. of Br. Columbia, Vancouver, British Columbia, Canada). 1970. LOCOMOTOR ACTIVITY RESPONSES IN JUVENILE SOCKEYE SALMON, Oncorhynchus nerka, TO MELATONIN AND SEROTONIN. Can. J. Zool., 48(6): 1425-1427.

Intraperitoneal injections administered for 3 consecutive days to juvenile sockeye salmon resulted in selective activity responses to either the light or the dark phase of the photoperiodic cycle. Serotonin increased locomotor activity only during the dark phase, while melatonin decreased locomotor activity only during the light phase. (Auth.)

14631. Hartman, G. F. (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1970. NEST DIGGING BEHAVIOR OF RAINBOW TROUT (Salmo gairdneri). Can. J. Zool., 48(6): 1458-1462.

A wild population of rainbow trout (Salmo gairdneri) was observed during spawning in the Lardeau River in southeastern British Columbia, in April and May in 1966 and 1967. Nest digging in the first few days of spawning in 1967 was predominantly nocturnal, but diurnal nest digging increased until activity was nearly steady around the clock. Rate of digging (digging bouts per 10-min interval) averaged near five before spawning, rose sharply immediately after spawning, and then decreased. The number of body flexures per bout of digging was near six before spawning, decreased sharply right after spawning, and then rose progressively over a 50-min period. Touching or feeling the bottom of the nest was frequent before spawning and decreased after. The effect of internal stimuli (egg release) and tactile stimuli on digging behavior is considered. (Auth.)

14632. Bayliff, William H. (Scripps Inst. of Oceanography, La Jolla, California). 1971. ESTIMATES OF THE RATES OF MORTALITY OF YELLOWFIN TUNA IN THE EASTERN PACIFIC OCEAN DERIVED FROM TAGGING EXPERIMENTS. Inter-American Tropical Tuna Comm., Bull. 15(4): 381-418.

Tag release and return data for the Baja California and Gulf of Guayaquil areas were selected for this study because substantial numbers of returns resulted from these releases and because the effects of emigration are small in these areas. The returns of tags per unit of fishing effort for several experiments in each area were used to estimate the coefficients of total mortality and shedding. The coefficient of annual natural mortality was estimated to be less than 2.0, which is in agreement with a previous estimate of 0.8, but does not improve upon it. The estimates for the average coefficients of catchability are 2.02×10^{-3} for the Baja California area and 0.67×10^{-3} for the Gulf of Guayaquil area. (Auth.)

14633. Bakkala, Richard G. (NMFS Biol. Lab., Seattle, Washington). 1971. DISTRIBUTION AND MIGRATION OF IMMATURE SOCKEYE SALMON TAKEN BY U. S. RESEARCH VESSELS WITH GILLNETS IN OFFSHORE WATERS, 1956-67. Int. North Pac. Fish. Comm., Bull. 27, pp. 1-70.

Offshore studies of Pacific salmon with gillnets have been conducted by the U.S. National Marine Fisheries Service since 1955. The principal area investigated was the North Pacific Ocean between 155°W and 175°E, but some studies also were made in the Bering Sea. Reported are the following findings on immature sockeye salmon (Oncorhynchus nerka) as obtained from data collected from 1956 to 1967: their distribution geographically and in relation to oceanographic features, their abundance within this distribution, and their migrations. Immature sockeye salmon were largely separated from maturing fish in the winter; they were mainly south of 50°N, whereas most maturing fish were north of this latitude. The immatures remained in the more southerly waters of the Subarctic Region until late spring. In June they moved north to occupy waters in the North Pacific Ocean extending northward from 49°N to the Aleutian Islands and the Alaska Peninsula. Main concentrations were at similar latitudes (51°-52°N) throughout this area in summer and therefore were much nearer shore off the central Aleutian Islands than off the Alaska Peninsula. Many of the fish that matured the following summer remained in these more northerly waters until they departed for spawning areas the following spring. Those that remained immature another two years returned to the more southerly waters in winter. The distribution of immature sockeye salmon was examined in relation to defined oceanographic features of the Subarctic North Pacific Ocean (Alaskan Stream, Ridge, Oyashio Extension, Subarctic Current, and Transition Areas), but the influence of these features on distribution and migration was not determined. Current hypotheses on the migrations of sockeye salmon originating from Bristol Bay, Alaska, were reviewed and some changes in these hypotheses were suggested by data presented here. (Auth.)

14634. LaLanne, John J. (NMFS Biol. Lab., Seattle, Washington). 1971. MARINE GROWTH OF CHUM SALMON. Int. North Pac. Fish. Comm., Bull. 27, pp. 71-91.

Lengths of chum salmon (Oncorhynchus keta) in gillnet catches in the North Pacific Ocean and Bering Sea from about May to September and in samples taken inshore are used to estimate rates of growth offshore and during migration to coastal waters. Rates are calculated for chum salmon taken in eastern waters (east of 165°W) and in western waters (west of 180°). Rates in length are converted to rates in weight. Although chum salmon in western waters are smaller, their monthly growth rates average 62% greater. Rates are similar for maturing and immature fish of the same age group. Monthly growth rates of age .3 fish are considerably greater during migration to the coast than during May to September offshore. Long-term growth from the immature stage of age .1 to the immature and maturing stages of age .3 averages 44% greater for chum salmon in western waters. The instantaneous growth rates in weight for the penultimate and final year of age .3 fish in eastern waters are 1.215 for summer spawners and 1.698 for autumn spawners; for those in western waters they are 1.506 and 1.932. (Auth.)

14635. Boddingius, J., and E. M. Fallaux (Zool. Lab., Univ. of Groningen, The Netherlands). 1970. ARGYROPHIL ADENOHYPOPHYSIAL CELLS IN THE RAINBOW TROUT (Salmo irideus), DEMONSTRATED SIMULTANEOUSLY WITH CHROMOPHIL CELLS AND WITH INTRACELLULAR ARGYROPHIL FIBRILS BY A NEW TECHNIQUE. Netherlands Journal of Zoology, 20(2): 291-297.

Argyrophil cells were revealed in the proximal pars distalis of the hypophysis in the rainbow trout (Salmo irideus). For the demonstration of the cells a new silver technique was used. Simultaneously with the argyrophil cells, an argyrophil fibrillar structure - which is supposed to be functional in the process of nuclear amitosis - was shown in cells of the pars intermedia and of the proximal pars distalis. The copper sulphate-silver protein technique can be combined with azan or aldehyde-fuchsin with very good results for remaining adenohypophysial cell types or for neurosecretory fibres. A complete histological picture of the adeno (and neuro-) hypophysis is thus obtained. (Authors summ.)

14636. Kubota, Minoru, Koichi Hagiya, and Shigeru Kimura (Lab. of Biochem., Tokyo Univ. Fish., Minato-ku, Tokyo, Japan). 1971. AMINO ACID COMPOSITION AND SOLUBILIZATION OF FISH EGG SHELL MEMBRANE. J. Tokyo Univ. Fish., 57(2-1): 87-94. In Japanese with English abstract.

The present study was performed to explain the chemical constitution of fish egg shell membrane, since only little information has been known so far except for salmon (Salmo salar). Egg shell membranes of rainbow trout, carp and flounder were isolated and analyses of their amino acids were made. The distribution of amino acids in fish egg shell membranes differed considerably from that in so-called eukeratins, particularly in the low content of cystine and in the molar ratio of basic amino acids (histidine-lysine-arginine). However, a marked difference was not observed among egg shell membranes of different fish species in their amino acid compositions. These results indicated that the protein constituting the fish egg shell membranes was one of ichthulokeratins which were classified as a pseudokeratin. The degree of solubilization of egg shell membranes by the action of reducing agents (thioglycolic acid and mercaptoethanol) did not differ so much as compared with that of calf hair, indicating that there was no apparent relationship between the cystine content and the solubility of keratins by the reducing agents. On the other hand, the egg shell membranes were more resistant against oxidizing agents (hydrogen peroxide and chlorous acid) than calf hair. Furthermore, it is very interesting that the egg shell membrane of fertilized egg of rainbow trout proved be be more resistant against the reducing agents than that of the unfertilized egg.

14637. Sakata, Kanzo, Kazuyoshi Kawazu, and Tetsuo Mitsui (Dept. of Food Sci. and Tech., Kyoto Univ., Kyoto, Japan). 1971. STUDIES ON A PISCICIDAL CONSTITUENT OF Hura crepitans. PART I. ISOLATION AND CHARACTERIZATION OF HURATOXIN AND ITS PISCICIDAL ACTIVITY. Agr. Biol. Chem., 35(7): 1084-1091.

Huratoxin, $[\alpha]_D^{28}$ + 55.1 (c=2.69, $CHCl_3$), a piscicidal constituent,was isolated from the sap of Hura crepitans. It was elucidated to have the formula $C_{34}H_{48}O_8$ and contain a 1,3-trideca-dienyl, an isopropenyl, a secondary methyl, an α-methyl-cyclopentenone, an epoxide and three hydroxyl (primary, secondary and tertiary) groups. Its piscicidal activity was evaluated to be about 10 times that of rotenone.

14638. Prather, E. E., and R. T. Lovell (Auburn Univ. Agric. Exp. Sta., Auburn, Alabama). 1971. EFFECT OF VITAMIN FORTIFICATION IN AUBURN NO. 2 FISH FEED. Presented at the 25th Ann. Conf., Southeastern Assoc. of Game and Fish Commrs, Oct. 17-20, 1971, Charleston, S. C.

Vitamin fortification of the Auburn No. 2 pelleted fish feed increased net production of channel catfish an average of 19.3 percent in feeding tests conducted in replicated earthen ponds between April 13 and November 9, 1970. A stocking density of 4,000 fingerlings acre was used and the fish were fed 6 days per week. In comparison to a second commercial catfish feed containing identical vitamin fortification the fortified Auburn No. 2 feed produced an increase in net production of 39.5 percent. Feed conversion, gain per day and average weight of fish at harvest were all superior with the fortified Auburn No. 2 feed when compared to the other two rations. (Authors)

14639. Kihlstrom, J. E,, C. Lundberg, and L. Hulth (Inst. of Zoophysiol., Box 560, S-751 22 Uppsala, Sweden). 1971. NUMBER OF EGGS AND YOUNG PRODUCED BY ZEBRAFISHES (Brachydanio rerio, Ham.-Buch.) SPAWNING IN WATER CONTAINING SMALL AMOUNTS OF PHENYLMERCURIC ACETATE. Environmental Research, 4(4): 355-359.

The number of eggs laid and their frequency of hatching have been studied in the zebrafish (Brachydanio rerio Ham.-Buch.) before and after the addition of phenylmercuric acetate to water. The number of eggs decreased in water containing 1 ng or more of phenylmercuric acetate per gram of water. The median effective dose (ED_{50}) is 2.2 ng/g of water. The frequency of hatching was diminished in eggs spawned in water containing 0.2 and 1 ng phenylmercuric acetate per gram of water. (Authors)

14640. Christensen, G. M. (EPA, Nat. Water Qual. Lab., 6201 Congdon Blvd., Duluth, Minnesota). 1971. EFFECTS OF METAL CATIONS AND OTHER CHEMICALS UPON THE IN VITRO ACTIVITY OF TWO ENZYMES IN THE BLOOD PLASMA OF THE WHITE SUCKER, Catostomus commersoni (Lacépède). Chem.-Biol. Interactions, 4 (1971/72), pp. 351-361.

Relative changes in the activity of glutamic oxalacetic transaminase (GOT, L-aspartate-2-oxoglutarate aminotransferase) and lactic dehydrogenase (LDH, L-lactate-NAD oxidoreductase) in blood plasma from white suckers were determined after incubation with 49 compounds, principally inorganic chlorides, at concentrations of the ions up to 2 mg/ml in the reaction mixture. A sequence of inhibitory effect was arranged for each enzyme. Dose-response curves were qualitatively similar for most of the chemicals. GOT was most sensitive to silver and mercury and LDH to palladium and mercury. Both enzymes are highly inhibited by metals which are highly toxic to aquatic animals. Correlations were studied between the inhibitory effect and certain physicochemical properties of chemicals, the best being found between the inhibition of GOT and the equilibrium constants of metal sulfides. (Auth. summ.)

14641. Bortone, Stephen A. (Dept. of Biol. Sci., Florida State Univ., Florida). 1971. STUDIES ON THE BIOLOGY OF THE SAND PERCH, Diplectrum formosum (PERCIFORMES: SERRANIDAE). State of Fla. Dept. of Natural Resources, Technical Series No. 65, pp. 1-27.

Biology of the hermaphroditic serranid, Diplectrum formosum, was studied during 1969 in the northern Gulf of Mexico. The species ranges from North Carolina to Uruguay and throughout the Gulf of Mexico. In the northern Gulf the species commonly occurs at depths of 50 m or less, over sand bottom at the base of low-lying reefs or other bottom formations. The species does not tolerate colder water and moves offshore at the onset of winter. Salinities at which the species is found approach that of normal open sea water. Fish species associated with D. formosum are those typical to the bottom habitat of reef communities. Length-weight relationship can be expressed by $W = 0.00935\ L^{3.04051}$. Maximum age attained in the specimens examined was six years; maximum size was 223 mm SL. Growth rate for D. formosum is moderate with the maximum growth increment occurring between the second and third years of life. Reproduction in D. formosum occurs in late spring and summer. The species shows synchronous hermaphroditism, with a modified Serranus-type gonad. There was no evidence to indicate the occurrence of self-fertilization. Stomach analyses indicated that shrimp and crabs made up a large portion of the diet. Amphipods were relatively important for smaller fish, while larger fish consumed a greater amount of bottom fishes. The species tends to set up home areas in which it carries out its life activities. It also shows a diurnal activity pattern which has been substantiated by laboratory experiment. Changes in color are due to preservation, activity and growth. (Auth.)

14642. Pike, David J. (Wellington Acclimatisation Soc., Wellington, New Zealand). 1971. TOXICITY OF CHLORINE TO BROWN TROUT, Salmo trutta Linn. Wellington Acclimatisation Society Ann. Report and Financial Statements, pp. 43-46.

This paper deals with the responses of the brown trout (Salmo trutta Linn) to free chlorine residuals in freshwater, and the potential toxicity that sometimes results when waste water containing free chlorine residuals, is discharged from sewage and water treatment plants, into a receiving river or stream. Hatchery reared yearling brown trout were killed experimentally by exposure for one hour to free chlorine residuals, at levels as low as 0.04 mg/l, and to continuously maintained free chlorine residuals at level as low as 0.01 mg/l. At 0.01 mg/l free chlorine in water, 50 percent of the test fish died in 43.5 hours. The implications of the discharge of chlorinated waste water and sewage into freshwater fisheries is discussed. (Auth. summ.)

14643. Lachner, Ernest A., and Robert E. Jenkins. 1971. SYSTEMATICS, DISTRIBUTION, AND EVOLUTION OF TH[E] Nocomis biguttatus SPECIES GROUP (FAMILY CYPRINIDAE: PISCES) WIT[H] DESCRIPTION OF A NEW SPECIES FROM THE OZARK UPLAND. Smith[s.] Contributions to Zoology, No. 91, 28 p. For sale by Supt. of Documents, U.S. [Gov't.] Printing Office, Wash., D. C., 40 cents.

This study treats the three allopatric species of the Nocomis biguttatus group: N. biguttatus, N. effusus, and N. asper, a new species. The systematics, distribution, ecology, evolution, and zoogeography of the species are compared. The region of the Ozark upland is emphasized because it is inhabited by the new species. N. asper is distinguished from N. biguttatus mainly in having a characteristic tuberculation pattern present on the body of the adults which never appears on the latter species. N. asper differs from N. effusus primarily in having two rows of pharyngeal teeth compared to one row in the latter, and in having about one fourth of its tuberculate body scales bearing two or more tubercles compared with only 3 percent bearing two tubercles in the latter species. The coloration of the nuptial males of the three species differs. Nocomis biguttatus is a wide-ranging form found naturally in the Missouri, upper Mississippi, northern Ohio, and the Great Lakes drainages. It avoids the nonglaciated regions of the upper Mississippi and Ohio drainages. This species is restricted to a few scattered populations in the middle and lower Missouri drainage - evidence of a once more widely distributed species that has been largely extirpated from this drainage mainly by the erosional history of the area, increased agricultural practices, and by droughts. N. asper and N. effusus have restricted distributions on opposite sides of the Mississippi Valley. N. asper is contained chiefly in the Ozark upland of the Arkansas River drainage of the tri-state area of Arkansas, Oklahoma, and Missouri, with probable isolated populations in the upper Neosho system of Kansas and in the Arkansas drainage of central Oklahoma, and a well-established population in the Blue River system, Red drainage, of south-central Oklahoma. Such isolated populations also are regarded as evidence of a wider distribution of these species in these drainages in the past. The disjunct populations of N. asper are paralleled closely by the occurrence of isolated populations of Notropis pilsbryi in the Arkansas River and Red River drainages. N. effusus is confined in the southwestern Ohio River basin to the Duck River system of the lower Tennessee drainage, the lower and middle Cumberland River drainage below its falls, and in the upper Green River drainage. The species of the biguttatus group chiefly inhabit tributaries and avoid the main rivers. Clear-water streams, small-to-moderate in size, with low-to-moderate gradients, and with clean substrates of gravel, rubble, and some sand, provide the preferred ecological requirements. Generally, the preferred streams have a moderate balance of riffles and pools. Turbid or silt-laden waters are avoided. The Nocomis biguttatus species group is considered to be the most primitive group within the genus; this assumption is based mainly on the generalized pattern of tuberculation on the head and on the presence of two rows of pharyngeal teeth. The primitive condition persists in N. biguttatus. The body tuberculation in N. asper and N. effusus (absent in N. biguttatus) demonstrates evolution of another type of tubercle pattern in Nocomis. The reduction in the number of tubercles per scale, the reduction in the distribution of tuberculate body scales, and the increase in the size of tubercles on the scales of the body of N. effusus are regarded as specialized conditions and correlate with the evolutionary trends of head tubercle development in the two other species groups of Nocomis. (Authors)

14644. Haastein, T., and G. Holt (National Veterinary Inst., Oslo, Norway). 1972. THE OCCURRENCE OF VIBRIO DISEASE IN WILD NORWEGIAN FISH. J. Fish Biol., 4(1): 33-37.

The occurrence of vibrio disease in coalfish, cod, dab, flounders, plaice and salmon from Norwegian waters is described. A description of the pathological findings and of the bacteriological examinations carried out is given. The causative agent was found to be Vibrio anguillarum, and the reactions of these Norwegian isolates in relation to previously described biotypes of V. anguillarum are discussed. (Authors)

14645. Matsumoto, Walter M., Elbert H. Ahlstrom, S. Jones, Witold L. Klawe, William J. Richards, and Shoji Ueyanagi (NMFS, Southwest Fish. Center, Honolulu, Hawaii). 1972. ON THE CLARIFICATION OF LARVAL TUNA IDENTIFICATION PARTICULARLY IN THE GENUS Thunnus. NOAA Fish. Bull., 70(1): 1-12.

A Larval Tuna Identification Workshop was held at the Bureau of Commercial Fisheries Biological Laboratory (now the National Marine Fisheries Service, Southwest Fisheries Center), Honolulu, Hawaii, on March 2-6, 1970 to resolve conflicting views on the identification of larvae of Thunnus alalunga and T. albacares and to clarify the status of larval identification of other Thunnus species. The The identification of T. alalunga (Yabe and Ueyanagi, 1962), T. albacares (Matsumoto, 1958), T. obesus (Matsumoto, 1962), and T. thynnus (Yabe, Ueyanagi, and Watanabe, 1966) was agreed upon as correct, except that the description of T. albacares should include the appearance of black pigmentation at the tip of the lower jaw when the larva attains a length of about 4.5 mm SL and that the lower size limit of reliable identification of T. alalunga be set at about 4.5 mm SL until further studies indicate more precisely whether the black pigmentation at the tip of the lower jaw in T. albacares appears earlier. There was no difference in appearance of T. thynnus larvae from the Atlantic and Indo-Pacific Oceans. The identification of T. tonggol and T. maccoyii larvae was not conclusive. The larvae of T. atlanticus required further study. The workshop further concurred that juveniles (13-200 mm SL) of several species of Thunnus may be separated by internal and external characters: T. atlanticus by vertebral count, T. alalunga by shape of first elongate haemal spine and arrangement of pterygiophores of the second dorsal fin relative to two adjacent neural spines, and T. thynnus by configuration of lateral line and arrangement of pterygiophores of the second dorsal fin; and that juveniles of T. obesus and T. albacares may be separated from the previous three species by arrangement of pterygiophores of the second dorsal fin, but not from each other. (Authors)

14646. Parsons, T. R., K. Stephens, and M. Takahashi (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1972. THE FERTILIZATION OF GREAT CENTRAL LAKE. I. EFFECT OF PRIMARY PRODUCTION. NOAA Fish. Bull., 70(1): 13-23.

Commercial fertilizer was added at a rate of 5 tons per week to a lake (51 km^2, mean depth 200 m) over a period of 5 months from May to October 1970. As a result of these additions, surface primary production was increased approximately tenfold while the primary production of the euphotic zone was doubled. The standing stock of primary producers and water clarity were substantially the same as in the previous year when no fertilizer was added. The productive index (mg C/mg Chl a/hr) was increased, especially in the immediate area of nutrient enrichment. However, the principal phytoplankton species were very similar at locations near and distant from the area of fertilization. In conclusion, it appears that as a result of adding nutrients at a low but sustained level, primary productivity was increased without substantially changing the nature of the food chain at the primary level of production. (Authors)

14647. Barraclough, W. E., and D. Robinson (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1972. THE FERTILIZATION OF GREAT CENTRAL LAKE. III. EFFECT ON JUVENILE SOCKEYE SALMON. NOAA Fish. Bull., 70(1): 37-48.

Nutrient levels and rates of primary production in nursery lakes are factors which may limit production of sockeye salmon. This paper describes the effect of artificial fertilization on feeding behavior and growth of juvenile sockeye salmon in Great Central Lake, Vancouver Island, British Columbia. Underyearling sockeye salmon grew 30% larger in 1970 than in 1969 as a result of adding 100 tons of fertilizer to Great Central Lake. The growth pattern for the whole population was complex, however, and the increase in size of juvenile sockeye was not as much as had been expected from the increase in quantity of their food organisms. The fact that the sockeye did not appear to appreciably crop the high epilemnetic concentrations of zooplankton during July and August 1970 may have been partly due to avoidance of high temperatures by the fish. (Authors)

14648. LeBrasseur, R. J., and O. D. Kennedy (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1972. THE FERTILIZATION OF GREAT CENTRAL LAKE. II. ZOOPLANKTON STANDING STOCK. NOAA Fish. Bull., 70(1): 25-36.

The regional, vertical, and seasonal abundance of the dominant zooplankton species were studied in conjunction with a series of nutrient additions to Great Central Lake. Two rotifer species, Kellicottia spp., Conochilus unicornis, three cladocera species, Bosmina coregoni, Holopedium gibberum, and Daphnia longiremis, and three copepod species, Cyclops bicuspidatus thomasi, Epischura nevadensis, and Diaptomus oregonensis were the most numerically abundant zooplankton species. The introduction of the fertilizer and the consequent higher rate of primary production produced no changes in the species composition. The zooplankton exhibited a relatively uniform horizontal distribution within the upper 20 m along the lake, a factor which was attributed to the lake circulation. All eight species were concentrated in the euphotic zone (upper 40 m), and five were most abundant in the upper 10 m. The center of abundance for the remaining three species was between 20 and 30 m depth. The respective depths of maximum abundance for the various species showed little variation between daylight and darkness. Seasonally, there were two periods, June to July and September to October, of maximum abundance for most species. The cause for somewhat lower levels of abundance in August is not known. The average zooplankton biomass showed a similar seasonal pattern with a maximum weight in July which exceeded 8 g/m^2. The average biomass over a 6-month period, May through October, exceeded 5 g/m^2 (more than 10 times greater than for the comparable period prior to fertilization in 1969). In contrast to the high standing stock of zooplankton, the estimated growth rate for underyearling sockeye salmon, the principal predator species in the lake, was only slightly improved over 1969 (1.2 vs. 0.9%/day). In comparison with other lakes producing young salmon the growth rates appear low with respect to the zooplankton stock. It was suggested that the temperature structure of the lake, 14° to 23°C above the thermocline and 4° to 6°C below the thermocline, may reduce availability and prevent the efficient utilization of the zooplankton by the underyearling sockeye salmon. (Authors)

14649. Drucker, Benson (NMFS, Auke Bay Fish. Lab., Auke Bay, Alaska). 1972. SOME LIFE HISTORY CHARACTERISTICS OF COHO SALMON OF THE KARLUK RIVER SYSTEM, KODIAK ISLAND, ALASKA. NOAA Fish. Bull., 70(1): 79-94.

This paper contains data on some life history characteristics of the coho salmon of the Karluk River system, Kodiak Island, Alaska: age, fecundity, length, and egg size of adults; and migration characteristics, age and size of smolts. The greater age at maturity of Karluk coho salmon (4 and 5 years) because of the longer freshwater residence of the juveniles is unique among reported North American stocks and may result in greater freshwater mortality but less marine mortality because the smolts are larger when they enter the ocean. Fecundity of Karluk coho salmon also differs from that reported for other North American stocks in that they are extremely fecund - more similar to Asiatic stocks of the Kamchatka Peninsula. (Auth.)

14650. Kepshire, Bernard M., Jr., and William J. McNeil (Dept. of Fish. and Wildl., Oregon State Univ., Marine Sci. Center, Newport, Oregon). 1972. GROWTH OF PREMIGRATORY CHINOOK SALMON IN SEAWATER. NOAA Fish. Bull., 70(1): 119-123.

A potential demand exists in sea farming for premigratory juvenile Pacific salmon that have been acclimated to seawater. This paper reports experiments on growth of premigratory chinook salmon (Oncorhynchus tshawytscha) acclimated to water of 33 °/oo salinity and lower and describes a simple mathematical model to evaluate rate of growth. Although chinook salmon raised in these experiments experienced low mortality in water of high salinity, their growth slowed. Reasons for slow growth at high salinity are discussed. (Authors)

14651. Lewis, Robert M., E. Peter H. Wilkens, and Herbert R. Gordy (NMFS Atlantic Coastal Fish. Center, Beaufort, North Carolina). 1972. A DESCRIPTION OF YOUNG ATLANTIC MENHADEN, Brevoortia tyrannus, IN THE WHITE OAK RIVER ESTUARY, NORTH CAROLINA. NOAA Fish. Bull., 70(1): 115-118.

Atlantic menhaden exhibit three different stages - larva, prejuvenile, and juvenile - during their stay in the estuary. For specimens collected from the White Oak River estuary, N. C., the length-weight relation was $\log_e Y = -8.1104 + 3.6050 (\log_e X)$ for larvae, $\log_e Y = -16.9638 + 6.3083 (\log_e X)$ for prejuveniles, and $\log_e Y = -5.2298 + 3.1452 (\log_e X)$ for juveniles, where Y = weight in mg and X = length in mm. Larvae and prejuveniles concentrated in the low salinity-freshwater zone upstream. Juveniles tended to move downstream toward the higher salinity water. Condition factors of larvae and prejuveniles increased toward the higher salinity zone. (Authors)

14652. Mosher, Kenneth H. (NMFS, Northwest Fish. Center, 2725 Montlake Blvd. East, Seattle, Washington). 1972. SCALE FEATURES OF SOCKEYE SALMON FROM ASIAN AND NORTH AMERICAN COASTAL REGIONS. NOAA Fish. Bull., 70(1): 141-183.

Photographic plates of sections of sockeye salmon scales, with descriptions, and frequency tables of the number of circuli in the freshwater and first ocean zones illustrate the variations in scale features of fish over the range of the species in coastal regions of Asia and North America. Suggestions are also given for using these data to determine the geographical origin of sockeye salmon taken in offshore areas of the North Pacific Ocean and adjacent waters. (Auth.)

14653. Major, Richard L., and Gerald J. Paulik (NMFS, Northwest Fish. Center, 2725 Montlake Blvd. East, Seattle, Washington). 1972. EFFECT OF ENCROACHMENT OF WANAPUM DAM RESERVOIR ON FISH PASSAGE OVER ROCK ISLAND DAM, COLUMBIA RIVER. NOAA Fish. Bull., 70(1): 125-140.

The filling of Wanapum Reservoir in 1964 flooded the lower sections of the three fish ladders at Rock Island Dam, 61 km upstream from Wanapum Dam on the Columbia River. To maintain fish passage under the new hydraulic conditions, the lower portions of the center and left-bank fish ladders of Rock Island Dam were rebuilt and a new sequence of spill patterns inaugurated. The effectiveness of these modifications was evaluated by comparing results from a series of tagging experiments conducted in 1964-65 on spring chinook salmon (Oncorhynchus tshawytscha) and sockeye salmon (O. nerka) with the results of similar experiments in 1954-55 before Wanapum Dam was built. These comparisons indicated fish passage over Rock Island Dam had improved substantially between 1954-55 and 1964-65; tagged fish traveled over the dam in a shorter time, and higher percentages of the tagged groups were sighted passing over the dam under postencroachment conditions. (Authors)

14654. Cahn, Phyllis H. (Graduate Dept. of Mar. Sci., Long Island Univ., P.O. Greenvale, L. I., New York). 1972. SENSORY FACTORS IN THE SIDE-TO-SIDE SPACING AND POSITIONAL ORIENTATION OF THE TUNA, Euthynnus affinis, DURING SCHOOLING. NOAA Fish. Bull., 70(1): 197-204.

This study was designed to demonstrate the role of the lateral line sensory system in fish schooling. Groups of 2, 3, 4, and 6 adult Euthynnus affinis were filmed during schooling orientation in the presence or absence of transparent partitions between them. When the hydrodynamic field between orienting fish was blocked by the partition, they significantly increased their side-to-side spacing, and changed their diagonal to abeam position ratios so that abeam orientation assumed increased importance. Apparently, hydrodynamic contact is essential for the typical spacing and positional orientation in schooling, and the lateral line, as the water turbulence detector, plays a prime regulatory role. (Auth.)

14655. Hudson, Patrick L. (Bur. Sport Fish. & Wildl., No. Central Reservoir Investigations, Yankton, South Dakota). 1971. THE CHIRONOMIDAE (DIPTERA) OF SOUTH DAKOTA. Proc. S.D. Acad. Sci., Vol. 50, pp. 155-174.

14656. Hill, Thomas K., Garland B. Pardue, and Barry W. Smith (Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1971. AN EVALUATION OF SEVERAL MARKS ON CHANNEL CATFISH, Ictalurus punctatus (Rafinesque). Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 304-307.

In November, 1969, four groups of channel catfish, Ictalurus punctatus (Rafinesque), with 20 fish per group were marked and put in cages in an earthen pond at the Auburn University Agricultural Experiment Station, Auburn, Alabama. Marking methods consisted of four dyes injected and applied with a tattoo machine, two fluorescent pigments and a hot and a cold brand. The fish were sampled weekly for a period of 28 weeks and each mark was evaluated on the basis of mark retention and ease of identification. Blue latex injections, hot brands and cold brands were the most effective marks used in this study. (Authors)

14657. Seehorn, Monte E. (USDA, Forest Serv., Southern Region, Atlanta, Georgia). 1971. A SURVEY PROCEDURE FOR EVALUATING STREAM FISHERIES. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 308-315.

A survey procedure was developed for judging the relative quality of trout waters and used in surveying streams in National Forests in Georgia, Virginia and South Carolina. The purpose of the survey was to provide land managers with information that would help in making decisions affecting trout streams. The procedure incorporates water quality analysis, fish population sampling, and a comparative evaluation of habitat conditions based on a stream's present and potential capability for producing wild or "native" trout fishing. Drainages surveyed ranged from one to over twenty miles in length. (Auth.)

14658. Carnes, W. Cape, and Darrell E. Louder (Div. of Inland Fish., No. Carolina Wildl. Resources Comm., Raleigh, North Carolina). 1971. A BATTERY POWERED AUTOMATIC FISH FEEDER FOR USE IN REMOTE AREAS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 316-320.

In an effort to supplement the food of fishes in remote areas lacking power lines and also to short-circuit the natural food chain, an automatic self-contained DC feeder was designed and built. The paper deals with the construction details of this feeder. (Authors)

14659. Sandow, Jack Thomas, Jr. (Ga. Fish and Game Comm., Georgia). 1971. A COMPARISON OF POPULATION SAMPLING RESULTS WITH THE TOTAL FISH POPULATION OF A 90-ACRE GEORGIA RESERVOIR. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 321-332.

The results from gill net samples, a series of cove rotenone samples, and a creel census were compared to the total fish population obtained through the drainage of Lake Russell, a 90-acre reservoir in Northeast Georgia. An extended period of gill netting yielded the best representation of the various fish species present in the reservoir, but gave a poor estimate of the relative abundance of the fish species. Cove rotenone samples of known acreage gave a good representation of the total weight per acre of the reservoir. The three coves sampled yielded 45.3 pounds per acre, 48.5 pounds per acre, and 73.0 pounds per acre. The three cove samples combined yielded a value of 54.1 pounds per acre. Upon drainage of the reservoir the total weight per acre of all fish was 48.4 pounds per acre. The deepest of the three coves, lacking an abundance of aquatic vegetation, was overestimated in terms of the actual weight per acre. The creel census gave a fair representation of the fish species present in the reservoir but poorly represented their relative abundance. In general, none of the sampling methods gave satisfactory estimates of the relative abundance of fish species. The cove rotenone samples were more reliable in representing bass and bluegill than any of the other sampling methods. (Auth.)

14660. Lewis, Steven A., and David D. Garriott (Okla. Fish. Res. Lab., Oklahoma). 1971. A MODIFIED FOLSOM PLANKTON SPLITTER FOR ANALYSIS OF METER NET SAMPLES. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 332-337.

The large number of meter net samples needed to determine the spawning success of various species of fish in Canton Reservoir, Oklahoma, made subsampling advantageous. The basic Folsom plankton splitter was enlarged and modified so that meter net samples with volumes up to 4,000 ml. could be split into 10 approximately equal subsamples. The splitter was constructed from a 12 inch diameter Plexiglas cylinder. Construction was accomplished using common shop tools. Chi-square tests (0.05 level) showed that there were no significant differences between the observed subsample counts and the expected counts. A nonparametric sign test showed that each chamber did not consistently have higher or lower counts than any other chamber. The minimum total number of organisms per sample that could be subsampled yielding estimates of the total sample number with less than a 10 percent error 95 percent of the time were determined for larval gizzard shad and larval Chaoborinae. Determination of the minimum number of organisms per sample needed for subsampling other organisms can be completed as necessary. (Authors)

14661. Ager, Lothian, and King E. Kerce (Fla. Game and Fresh Water Fish Comm., Florida). 1971. VEGETATIONAL CHANGES ASSOCIATED WITH WATER LEVEL STABILIZATION IN LAKE OKEECHOBEE, FLORIDA. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 338-351.

Ecological changes in plant communities in several Florida lakes have been noted by biologists in the past, but rarely have the parameters of these communities been documented for future reference. Soil moisture is an important factor in determining which plants will occur at particular elevations, but more important is the inundation tolerance of the various species. The purpose of this study was to compare the long range effects of water level fluctuation on the marsh vegetation of Lake Okeechobee. The Florida Game and Fresh Water Fish Commission, in 1956, conducted a vegetational analysis of the lake marsh in order to predict the probable results on vegetation from construction of a levee to contain the lake waters. A subsequent analysis of the same area was conducted by Commission personnel in 1969 to determine what vegetational changes had occurred. Comparison of the data from the two studies revealed that stabilization of the water level had occurred resulting in perennials replacing annual plants, an increased frequency of submergent species, and a decrease in total number of species present. (Authors)

14662. Summerfelt, Robert C., and Paul E. Mauck and Gary Mensinger (Okla. Coop. Fish. Unit, Okla. State Univ., Stillwater, Oklahoma). 1971. FOOD HABITS OF THE CARP, Cyprinus carpio L., IN FIVE OKLAHOMA RESERVOIRS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 352-377.

Alimentary tracts were examined of 1010 carp collected with gill and trammel nets by commercial fishermen from four riverine reservoirs, and 211 adult and 45 young carp from Lake Carl Blackwell, a headwaters reservoir. The alimentary tract contents of carp in five Oklahoma reservoirs contained algae, plant fragments, seeds, entomostraca, chironomids, Chaoborus, pelecypods, caddisflies, Ceratopogonidae, animal fragments, and organic and inorganic matter. Terrestrial insects were of rare occurrence. The major volumetric constituents in the alimentary tracts of carp from the riverine reservoirs Grand, Fort Gibson, Eufaula, and Texoma Reservoirs were: unidentified organic matter (65.5%), animal fragments (12.5%), plant fragments (10.1%), entomostraca (3.8%), algae (1.9%), pupae (1.1%). Adult carp collected by electrofishing from Lake Carl Blackwell, a headwaters impoundment, contained on a volumetric basis, 41.7% organic detritus, 35.9% plant matter (18.8% plant fragments, 11.8% seeds, 5.3% algae), 5.0% entomostraca, 3.1% chironomids, 0.2% Chaoborus, 8.9% animal fragments. Organic

detritus was also the major volumetric constituent (49.8%) of the 45 young carp (<9 inches total length) examined from Lake Carl Blackwell. Stomachs of young carp contained no algae, and fewer seeds and plant fragments than the adults, and a considerably larger volume of entomostraca (19.2% of the total volume). Carp seem to feed on the unconsolidated portion of the substrate. Organisms like tubificids, and burrowing mayflies and odonates, requiring consolidated substrate, were not present. The Cladoceran genus Chydorus which lives in the flocculent material at the substrate-water interface, predominated over limnetic genera like Bosmina and Daphnia. Seeds were very abundant in Carl Blackwell carp following a spring flooding of marginal vegetation. No fish eggs, fish fry, dragonflies, mayflies or oligochaetes were found in carp tracts, and only two tracts contained fish. There was considerable monthly and inter-reservoir variation in abundance of most items. In Lake Texoma, peak abundance of Cladocera and Copepoda in carp tracts coincided with the maximum inflow of water. In the Oklahoma reservoirs studied, carp probably have little effect on water quality or availability of aquatic plants. Food competition by carp is probably greatest with young game fishes, young and adult river carpsucker and smallmouth buffalo. The high relative abundance of carp, carpsucker and smallmouth buffalo is attributable to their consumption of particulate organic matter, and the community of decomposer organisms and the invertebrates which feed on the organic detritus. Direct competition with game fish would occur among larval game fish when food scarcity during the critical period could limit year class strength. Indirect food competition occurs between carp and larger invertebrate life which are utilized by juvenile game fishes. (Authors)

14663. Mathur, Dilip (Ichthyological Associates, Box 12, Drumore, Pennsylvania). 1971. FOOD HABITS AND FEEDING CHRONOLOGY OF CHANNEL CATFISH Ictalurus punctatus (Rafinesque), IN CONOWINGO RESERVOIR. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 377-386.

The single 24-hour feeding chronology study indicated that subadult and adult catfish fed heavily during the daylight hours although some feeding also occurred in the night. The major foods eaten by subadults and adults differed over the 24-hour period. Fishes formed the bulk of the diet at 0600 and 0900 hours and insects at 0400 and 2400 hours; whereas the zooplankton was the principal food at other periods. The presence of large amounts of detritus (sand and mud) during the times of heavy feeding indicated near-bottom feeding habits. Stomach contents of 798 subadult and adult channel catfish (122 to 270 mm fork length) collected from July to November, 1966 in Conowingo Reservoir were examined. Stomachs of 183 young catfish (35 to 83 mm) collected in August and September were also analyzed. By weight and on the basis of percentage frequency of occurrence zooplankton was the principal food of catfish of all sizes. Fishes were important in the diet of subadults and adults only in August and October. Amphipods comprised an important segment of the diet of subadults and adults only in November. Insects and algae were less important. (Auth.)

14664. Frey, John E. (Ga. Game and Fish Comm., Fort Valley, Georgia). 1971. AN INSTANCE OF THERMAL POLLUTION AND THE EFFECT ON TEMPERATURE AND OXYGEN LEVELS IN A MIDDLE GEORGIA RESERVOIR. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 408-418.

Limnological data collected during a four and one-half year period at Lake Sinclair is reviewed. Comparison of temperature and oxygen profiles are made in areas of the lake receiving hot water discharge and in unaffected areas. Hot water discharge was found to increase temperature and dissolved oxygen substantially during both summer and winter. In addition, hot effluent eliminated or altered the thermocline in the affected area. These effects were evident in varying degrees for 2.3 miles below the source. Observations concerning the sport fishery within the area receiving hot water discharge are noted. The possible effects of hot water discharge on the habitat and an aquatic ecosystem is also discussed. (Auth.)

14665. Turner, Paul R., and Robert C. Summerfelt (Okla. Coop. Fish. Unit, Okla. State Univ., Stillwater, Oklahoma). 1971. FOOD HABITS OF ADULT FLATHEAD CATFISH, Pylodictus olivaris (Rafinesque), IN OKLAHOMA RESERVOIRS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 387-401.

Food items were found in 47.0% of 1329 flathead catfish stomachs collected by gill and trammel nets from six Oklahoma reservoirs: Carl Blackwell, Eufaula, Fort Gibson, Grand, Hudson, and Texoma. The average number of food items was 1.6 per stomach and the average volume per stomach was 26.4 ml in stomachs with food. Fish comprised more than 95% of total food volume and total number of food items in all six reservoirs. Gizzard shad contributed from 49.5 to 91.7% of total stomach volumes. Freshwater drum were second in importance as forage, accounting for 3.3 to 38.2% of total volumes. Carp contributed 23.2 and 42.0% of total stomach volumes on lakes Eufaula and Hudson, respectively, but were not found elsewhere. Channel catfish comprised 13.8% of the stomach volume in flatheads from Fort Gibson Reservoir where they were very abundant. All species of centrarchids comprised only 5.4 to 10.0% of total stomach volumes in three reservoirs. The average standard length of 467 measurable forage fish was 127 mm. The average lengths of gizzard shad (age I+), freshwater drum and channel catfish were similar, ranging from 134 to 147 mm (S.L.). Of 718 identifiable fish, only two white crappie and one channel catfish were of harvestable size. Flathead catfish feeding activity was greatest in September through October and April through May. Feeding activity was less during the winter months and in June and July when spawning occurred. Feeding activity increased in August following spawning. Gizzard shad decreased in importance as forage during spring and summer months in most reservoirs. Centrarchids and channel catfish were more important during late spring and summer. Flathead catfish predation in reservoirs is probably determined by the availability of suitable-sized forage species near the reservoir bottom in water depths inhabited by flathead catfish. The desirability of flathead catfish as a predator in Oklahoma reservoirs is related to their predation on large forage fishes which are non-vulnerable to the average size piscivorous game fish. (Authors)

14666. Keith, William E., and Sammy W. Barkley (Ark. Game and Fish Comm., Arkansas). 1971. PREDATION ON STOCKED RAINBOW TROUT BY CHAIN PICKEREL AND LARGEMOUTH BASS IN LAKE OUACHITA, ARKANSAS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 401-407.

In many reservoirs predation on stocked fish has been considered as one of the major limiting factors in establishing a particular population. Following several years of water quality determinations it was found that Lake Ouachita maintained a sufficiently oxygenated hypolimnion to support trout. As a result several thousand catchable rainbow trout, Salmo gairdneri, were stocked into the lake. The results of this attempt to establish a trout fishery have been disappointing for a combination of reasons; however, while collecting for broodstock chain pickerel, Esox niger, and from fishermen reports, it became evident that predation on the stocked trout must be very high. Collections of largemouth bass, Micropterus salmoides, and chain pickerel were made with a boom-type electroshocker during January and February, 1970. Sampling was done at night within an approximate 100-acre area adjacent to a trout stocking point. Two separate areas were collected and collections were made the date on which trout were stocked, one day after stocking, two days after stocking, and eight days after stocking. During the collecting period a total of 14,840 nine inch trout were stocked in the two collecting areas. Eighty-six (86) largemouth bass, weighing 162.9 pounds and twenty-four (24) chain pickerel, weighing 33.1 pounds, were collected for stomach analysis. The smallest size bass containing trout in its stomach was sixteen (16) inches total length. The smallest chain pickerel in which a trout was found was fifteen (15) inches in length. Of all chain pickerel, fifteen inches and over, 54.5% had trout in their stomachs and 48.6% of the largemouth bass, sixteen inches and longer, contained trout. One hundred percent of the chain pickerel, nineteen inches or larger, and ten of the eleven bass, eighteen inches or larger, contained trout. Although the size trout stocked during these collections

averaged nine inches in length, 79.6% of the trout consumed were eight inches or less. No trout over nine and one-half inches was found in bass or pickerel stomachs; however, two or more trout per stomach was common and five was the maximum number of trout found in one stomach. (Authors)

14667. Crumpton, Joe (Fla. Game and Fresh Water Fish Comm. Fish. Res. Lab., Eustis, Florida). 1971. FOOD HABITS OF LONGNOSE GAR (Lepisosteus osseus) AND FLORIDA GAR (Lepisosteus platyrhincus) COLLECTED FROM FIVE CENTRAL FLORIDA LAKES. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 419-424.

Stomachs from 285 longnose (Lepisosteus osseus) and 603 Florida gar (Lepisosteus platyrhincus) were collected from five lakes in central Florida. Of all stomachs examined, 432 or 49 percent contained food items. Stomach data grouped from the two species and five lakes indicated that gar in central Florida lakes feed principally on nongame forage fish and do not extensively utilize game fish species. Nongame forage fish comprised 57 percent of the total number of food items consumed, while only 11 percent were game fish. (Auth.)

14668. Williams, Hampton M. (So. Carolina Wildl. Resources Dept., South Carolina). 1971. PRELIMINARY STUDIES OF CERTAIN ASPECTS OF THE LIFE HISTORY OF THE HYBRID (STRIPED BASS X WHITE BASS) IN TWO SOUTH CAROLINA RESERVOIRS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 424-431.

From 1967 through the spring of 1970 Lakes Hartwell and Clark Hill on the upper Savannah River between Georgia and South Carolina have been stocked with the striped bass Roccus saxatilis (Walbaum) X white bass, Roccus chrysops (Rafinesque) hybrids. A total of 30,000 fingerlings and 26,120,000 fry have thus far been introduced. Approximately 130 hybrids were captured during a one year period (1969-70) of which 87 were examined for age, growth rate, food habits and meristic characters. The average total lengths for three year classes were 12.6, 17.2 and 20.2 inches respectively and maximum weights were 3.7 pounds and 5.9 pounds for year class one and two respectively. These lengths and weights compare favorably with findings in Tennessee, Bishop (1967) and, as in Tennessee, were greater than reported in Virginia (1969) - (Howard Kerby, personal communication). Stomach contents of specimens examined indicated a definite preference for threadfin shad. Meristic characters as described by Bayless (1967) held up in all cases and, of the 130 hybrids observed, all but one exhibited the chain-like broken line effect. Spawning migration is apparent in the spring when the water temperature reaches 50°F. This is just prior to white bass migration with females apparently running earlier than males. (Auth.)

14669. Hughes, Janice S. (La. Wild Life and Fish. Comm., Louisiana). 1971. TOLERANCE OF STRIPED BASS, Morone saxatilis (Walbaum), LARVAE AND FINGERLINGS TO NINE CHEMICALS USED IN POND CULTURE. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 431-438.

Bioassays were conducted on nine chemicals using one week old larvae and one month old fingerling striped bass, Morone saxatilis (Walbaum), as the test species. The chemicals tested were potassium permanganate, potassium dichromate, copper sulfate, Dylox, ethyl and methyl parathion, Karmex, butyl ester of 2,4-D and HTH. Tests were conducted at 70° Fahrenheit in glass containers using reconstituted water as the diluent. The fingerlings were much more tolerant to Karmex, potassium dichromate, potassium permanganate and butyl ester of 2,4-D than were the larvae. A higher concentration of ethyl parathion, methyl parathion, HTH, copper sulfate or Dylox was required to kill the larvae than the fingerlings. (Auth.)

14670. Dawson, C. E. (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1971. A BIBLIOGRAPHY OF ANOMALIES OF FISHES. SUPPLEMENT 2. Gulf Research Reports, 3(2): 215-239.

This listing adds 213 titles to the original bibliography and the 1966 supplement.

14671. Ware, Forrest J. (Fla. Game and Fresh Water Fish Comm., Florida). 1971. SOME EARLY LIFE HISTORY OF FLORIDA'S INLAND STRIPED BASS, Morone saxatilis. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 439-447.

Striped bass, Morone saxatilis, were successfully established in Florida's fresh water lakes during the summer of 1968. Populations are presently known in at least six separate bodies of water. Lake stocking rates have ranged from 43 fish per acre to 5 fish per acre. All stocks were obtained from Moncks Corner Striped Bass Hatchery, South Carolina, as one to four day old fry and reared to approximately 2 inches (TL) at State hatcheries prior to stocking. Growth has been rapid but variable between populations. The average first year of growth was 11.1 inches (TL). Maximum growth for age I fish was 13.6 inches (TL). Age II striped bass averaged 18.1 inches (TL), weighing 2.35 pounds. Measurements of physical condition, K-factor (Hile), varied between 1.31 and 2.79. Values of K below 1.80 were indicative of poor condition and mortalities were associated with K-factor values below 1.70. Stomach analyses revealed a preponderance of threadfin and gizzard shad, Dorosoma petenense and D. cepedianum, in the diet, although other fishes were frequently utilized. Striped bass smaller than 6 inches (TL) fed predominately on mosquitofish, molly, and freshwater shrimp. Parasite caused mortalities occured in two striped bass populations. The causal organism was a marine nematode of the genus Goezia. (Auth.)

14672. Mensinger, Gary C. (Okla. Dept. of Wildl. Conserv., Oklahoma City, Oklahoma). 1971. OBSERVATIONS ON THE STRIPED BASS, Morone saxatilis, IN KEYSTONE RESERVOIR, OKLAHOMA. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 447-463.

The Oklahoma Department of Wildlife Conservation initiated a program to establish striped bass in Keystone Reservoir in 1965. During the period 1965 to 1969, approximately 2.75 million striped bass ranging from fry to adults have been stocked. A program to determine if a spawning population of striped bass had developed was started in March 1969. The search for natural reproduction utilized egg sampling, meter netting, shoreline shocking, and shoreline seining methods. Natural reproduction was not found in 1969. A gill net survey of the striped bass population was conducted from October through December 1969. Thirty individuals ranging in size from 0.9 to 8.9 pounds were taken. Females accounted for 80 percent of the catch with the larger individuals carrying mature ovaries. Age and growth determinations were made on these fish plus 20 others. First year growth was calculated at 10.2 inches, second year at 17.9 inches, third year at 21.3 inches, and fourth year at 23.9 inches. Egg sampling survey was repeated in 1970. Striped bass eggs were not identified from those taken. However, on June 18, the first six striped bass identified as natural reproduction were taken by shoreline seining. Primary spawning activity appeared to have taken place in the Arkansas River. Early survey results were negative in the Cimarron River. Using data collected in 1969, from seining rates and known stocking rates as an extrapolation base, the 1970 fingerling survival was calculated at 1.45 million minimum from data taken June 20 to June 25. Early observations on distributional patterns and growth rates of the fingerling striped bass are presented. (Auth.)

14673. Burress, Ralph M. (Southeastern Fish Control Lab., P. O. Box 9, Warm Springs, Georgia). 1971. IMPROVED METHOD OF TREATING PONDS WITH ANTIMYCIN A TO REDUCE SUNFISH POPULATIONS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 464-473.

A new method of using antimycin to thin overcrowded sunfish populations was tested in five ponds from 2.8 to 8.2 acres in surface area. Concentrations of 0.6 to 1.6 parts per billion of antimycin applied in the shallow upper ends of the ponds removed from 21.0 to 102.1 pounds per acre of sunfishes, but killed almost no largemouth bass of any size. The partial treatment method worked well in every pond in which it was tested despite some wide diurnal fluctuations in pH. Advantages of the new method are: 1) applications are based on easily obtained estimates

of water volume in the treated area and if the estimate of pond volume is in error either way, this method is likely to give useful results; 2) higher concentrations of antimycin can be used in the treated area, with little likelihood of eliminating all of the small forage fishes from the pond; and 3) there is an increased safety factor and costs of treatment are lower than for whole pond treatments. (Auth.)

14674. Bellinger, John W. (Bur. of Sport Fish. and Wildl., Vero Beach, Fla.) 1971. DREDGING, FILLING, AND THE INALIENABLE PUBLIC TRUST - THE FUTURE OF FLORIDA'S SUBMERGED ENVIRONMENT. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 473-482.

Dredging and filling, especially to create waterfront property, has had serious adverse effects on Florida's submerged environment. Primary adverse effects of dredging and filling are disturbance or elimination of established aquatic habitats. Dredging and filling peaked in Florida from the 1920's through the 1950's when large tracts of submerged land were sold to attract outsiders. Submerged lands are generally considered to be held in inalienable public trust and legal questions arise concerning sale of these publicly-owned lands. First controls over sale of submerged bottoms and dredging-filling were in the 1957 Bulkhead Act. In 1969 the State established a system of aquatic preserves and the 1970 Legislature passed a bill prohibiting the sale of submerged lands except when clearly in the public interest. The State of Florida and the Army Corps of Engineers share concurrent jurisdiction in the issuance of dredge-fill permits. The State is authorized under the Bulkhead Act and the Corps under the 1899 River and Harbor Act. Public concern over dredging and filling led to passage of several federal bills, including the National Estuary Study Act of 1968, the National Environmental Policy Act of 1969, and the Water Quality Improvement Act of 1970. The Corps of Engineers have announced they are no longer concerned only with navigation aspects and will give greater consideration to effects on natural resources. In view of recent state and federal actions concerning sale of submerged lands and dredge-fill permits the future of Florida's submerged environment appears bright. Plans to further protect and conserve our estuaries are needed. Such plans could entail coastal zoning and habitat rehabilitation. Coastal zoning should protect unique bio-ecological systems such as Florida's mangrove swamps. Estuarine areas damaged through dredging may, in some cases, be restored to biological productivity through habitat rehabilitation. This could include transplanting aquatic vegetation, placing rocks or shell on disturbed bottoms, or establishing artificial reefs in estuarine waters. (Auth.)

14675. Herring, Jack and Dan Cotton (Miss. Game & Fish Comm., Mississippi). 1971. PESTICIDE RESIDUES OF TWENTY MISSISSIPPI DELTA LAKES. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 482-488.

In 1969 the pesticide concentrations of 20 randomly selected Delta Lakes were evaluated by gas chromatograph. The DDT complex and toxaphene were the prevalent pesticides found in water, fish and bottom sediment. Lake waters were generally low in pesticide residues. Pesticide residues of DDT+metabolites and toxaphene in fish flesh ranged respectively from 0.15-10.60 p.p.m. and 0.0-20.0 p.p.m. Bottom sediment contained from 0.02-3.58 p.p.m. DDT+metabolites, while toxaphene ranged from 0.0-2.47 p.p.m. All lakes surveyed were found to contain pesticides. (Authors)

14676. Collins, Richard A. (State Coll. of Arkansas). 1971. CAGE CULTURE OF CATFISH IN RESERVOIR LAKES. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 489-496.

Catfish can be grown successfully in cages in large lakes in the presence of fishing and boating activity, and the channel is the more desirable species for this type of fish culture. The fish can tolerate temperatures of at least 95°F. without any adverse effects. The fish enter an arrested growth period when the temperature of the water is about 55°F. or lower, but the fish survive these winter temperatures exceptionally well. A conversion rate of approximately 1.3 can be

obtained routinely. Channels grow more rapidly when fed twice each day than when they are fed once each day, but blues do not show an increased growth rate when fed twice each day. There is no difference in growth or conversion rates when blues and channels are grown as single populations compared to mixed populations. Bacterial disease occurs among caged fish, but disease may be controlled by feeding antibiotics. Excessive disturbance of caged fish such as dipping into a cage, will retard the feeding activity for a period of time. (Auth. summ.)

14677. Meyer, Fred P., Don S. Godwin, Randy Boyd, J. Mayo Martin, D. Leroy Gray, and William P. Mathis. 1971. FISH PRODUCTION IN ARKANSAS DURING 1969 AS COMPARED TO OTHER STATES. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 497-505.

Economic returns from the commercial production of fish in Arkansas during 1969 were approximately double those of 1966. Acreages devoted to the culture of golden shiners and channel catfish in Arkansas showed major increases. The cash return from shiners was up 60 percent, and that from catfish increased almost fourfold. The overall return to Arkansas from all fish culture exceeded $17 million, whereas the nationwide return from baitfishes and catfish alone was nearly $35 million. Data collected from Arkansas fish farmers was analyzed with the aid of automatic data processing and are reported in the categories of Foodfish, Baitfish, Fingerlings, and Fee Fishing. Acreages, production and dollar values of each category are presented. In Arkansas, golden shiners are the leading species in terms of acreage and dollar production. Channel catfish for foodfish rank a close second in dollar value. Fingerling production has become a major industry in the state, exceeding $2 million in 1969. As in 1966, the sale of sportfish represented a negligible portion of Arkansas production. (Authors)

14678. Grinstead, Bobby G. (Okla. Fish. Res. Lab., Oklahoma). 1971. RELATIONSHIP OF INTERVAL BETWEEN LIFTS AND THE CATCH OF TEN-FOOT WISCONSIN-TYPE TRAP NETS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 532-545.

A study to determine the relationship of the interval of time between lifts and the catch of ten-foot Wisconsin-type trap nets was included as a segment of an investigation designed to determine the potential of utilizing trap nets as a commercial fishing device in warmwater reservoirs. Data obtained from the catch of 170 trap net lifts, which varied in interval of time between lifts from one to seven days, indicate that with an increase in the interval of time between lifts, the total catch increased while the catch per net day decreased. A logarithmic curve $Y = 73.866 + 235.229 \log X$, where Y equals total catch in pounds and X equals the interval of time between lifts in days, appears to best describe this relationship. The species composition of the catch also changed significantly as the interval of time between lifts increased. This change was the result of a decreasing percentage of gizzard and threadfin shad in the catch as the interval increased. It has been shown that stationary gear such as gill or trammel nets are most efficient when tended daily. Operating in this manner requires less time to tend the gear due to the smaller catch. In addition, mortality of the catch increases substantially with an increase in the interval of time between lifts. Trap net catches differ in that the time required to tend this gear varies only slightly with an increase in the size of catch and the mortality of fish in the crib does not appear to increase significantly with an increase in the interval of time between lifts. It is therefore possible to increase the total catch of a commercial fishing operation by increasing the number of trap nets and tending each one less frequently. The most efficient operation, considering the conditions under which this study was conducted, would have been to set 30 nets and lift each net every 3 days. (Auth.)

14679. Brown, Bradford E. (Okla. Coop. Fish. Unit, Stillwater, Oklahoma). 1971. IMPLICATIONS FROM THE OKLAHOMA STATE LAKE CREEL SURVEY TO IMPROVE CREEL SURVEY DESIGN. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 577-591.

14680. Sills, Joe B., and Paul D. Harman (Southeastern Fish Control Lab., Warm Springs, Georgia). 1971. EFFICACY AND RESIDUES OF QUINALDINE SULFATE, AN ANESTHETIC FOR STRIPED BASS (Roccus saxatilis). Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 546-549.

Striped bass (Roccus saxatilis) were exposed to solutions of quinaldine sulfate containing 10, 25, 40 and 55 p.p.m. of quinaldine. Fish were effectively anesthetized at concentrations of 25 to 55 p.p.m. Residue levels in muscle tissue of fish exposed to 40 p.p.m. of quinaldine at 4° C for 10 minutes reached 2.60 p.p.m. but were essentially gone after 24 hours of recovery in fresh water. (Authors)

14681. Snow, J. R. (Bur. Sport Fish. & Wildl., Marion, Alabama). 1971. FECUNDITY OF LARGEMOUTH BASS, Micropterus salmoides, Lacépède RECEIVING ARTIFICIAL FOOD. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 550-559.

Fecundity of largemouth bass, Micropterus salmoides, Lac. reared and maintained on two diets was measured by use of a technique of collecting naturally-spawned eggs from nylon felt spawning mats. A volumetric measurement was made of the eggs in 10 spawns from Year Classes I, II and III pellet-fed fish for comparison with eggs from Year Class II bass fed forage fish. Average eggs per spawn for the Year Class I fish was 9,551; for Year Class II pellet-fed, 21,744; for Year Class III, 15,223 and for Year Class II fish-fed, 19,410. The lower number of eggs produced by Year Class III fish than Year Class II is thought to be related to influence of the diet given during the first 14 months of feeding when a ration of dry trout feed and ground frozen fish was fed to this lot. Other than this, the artificial ration used was Oregon Moist Pellet. Apparent viability of eggs from bass receiving artificial food was higher than that of eggs from those on a natural diet. This was not thought to be related to diet however, Egg size was comparable between the two diets, but color was better in eggs spawned by bass on a natural diet. Measurements of ovaries removed from selected specimens paralleled those of sample spawns except that the number of ova per pound of body weight was highest in Year Class I pellet-fed specimens. A noticeable amount of fatty tissue was present in the ovaries taken from two- and three-year-old fish which had been fed artificial food. (Auth.)

14682. Bailey, William, and Randy L. Boyd (Ark. Game and Fish Comm., Little Rock, Arkansas). 1971. A PRELIMINARY REPORT ON SPAWNING AND REARING OF GRASS CARP (Ctenopharyngodon idella) IN ARKANSAS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 560-569.

Previous attempts to artificially spawn the grass carp have been unsatisfactory, with complete failure or insignificant success using the Russian method described by A. G. Konradt (1965). The same basic procedure, with variations in hormone, size of dose, and number of injections, proved to be successful in our attempt to spawn four year old fish. Human chorionic gonadotropin, used as stimulating injections, and dry, whole carp pituitary, used as the resolving injection, produced a high percent of viable eggs. Extending the period of development within the female from 36 hours to 60 hours proved to be more effective in producing mature eggs. The spawning season is approximately one month in Arkansas. Mechanical factors and physical conditions such as water temperature, density of eggs in jars, suspended clay particles, and rate of water exchange (rolling rate) effect the success of hatching in jars. Paddle wheels used to roll the eggs proved to be highly successful for hatching grass carp eggs. Grass carp fry show rapid growth and feed well on plankton and commercial minnow meal. Two hundred and seventy thousand (270,000) fry were produced during these experiments. (Authors)

14683. Hackney, Peter A., Gerald R. Hooper, and Joseph F. Webb (Alabama Dept. of Conserv., Game and Fish Div., Montgomery, Alabama). 1971. SPAWNING BEHAVIOR, AGE AND GROWTH, AND SPORT FISHERY FOR THE SILVER REDHORSE, Moxostoma anisurum (Rafinesque), IN THE FLINT RIVER, ALABAMA. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 569-576.

Spawning behavior, age and growth, and sport fishery for the silver redhorse, Moxostoma anisurum (Rafinesque), in the Flint River, Madison County, Alabama, were studied in 1969 and 1970. Spawning silver redhorse were first observed on April 1, 1969, and April 8, 1970, at a water temperature of 14.4°C. (58°F). Females appeared to mature between the sixth and seventh year at a length of 548-600 mm. Males appeared to mature at 510-530 mm., but most seemed to mature at the same age. Growth of males and females was approximately the same until age group VI. After this age, males grew slower than females. Mature specimens moved into Flint River from Wheeler Reservoir to spawn during February through April. Immature silver redhorse returned to Wheeler Reservoir where they remained until sexually mature. The most important fishery on the Flint River during early spring is for silver redhorse. (Authors)

14684. Holder, Daniel R. (Sport Fish. Div., Ga. Game and Fish Comm., Georgia). 1971. A STUDY OF FISH MOVEMENTS FROM THE OKEFENOKEE SWAMP INTO THE SUWANNEE RIVER. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 591-608.

The construction of a dike dividing the Okefenokee Swamp and the Suwannee River in 1960 and the phenomenal poundage of bowfin found in the river prompted an investigation to determine what fish were entering the river by passing over the dike from the swamp. Twenty thousand nine hundred and forty-six fish weighing 18,590.3 pounds were calculated to have moved over the spillway from February 20, 1969 to June 26, 1970. Bowfin comprised seventy-nine percent by weight of the fish and yellow bullhead were the most numerous species to come over. Ninety percent of the movement occurred at night. Movement was related to water temperature, depth of discharge, and spawning activity and is reported for each major species. The study establishes that the swamp does influence the river fishery and that the high bowfin population was, in part, due to their spilling over the dike. Management implications are discussed. (Auth.)

14685. Gray, John S. (Dept. of Zool., Univ. of Ark., Fayetteville, Arkansas). 1971. SEASONAL CYCLES OF NET PLANKTON IN A COLD-TAILWATER AND A NATURAL STREAM IN THE STATE OF ARKANSAS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 608-621.

The data herein presented compare the seasonal cycles of net plankton of a natural stream (Kings River) with a new tailwater (Beaver Reservoir, impounded in 1965). Quantitative net plankton abundance and physicochemical conditions at each area were monitored bimonthly from September 1967, through October 1968. Mid-winter blooms of Chrysophyta at the Beaver Dam stations were preceded by an increase in average monthly temperatures and followed by a decrease in silica concentrations. Downstream from Beaver Dam, late summer blooms of Cyanophyta were recorded. Most of these increases occurred in conjunction with high average dissolved oxygen concentrations and temperatures. At the Kings River, winter blooms of Chlorophyta coincided with maximum dissolved oxygen concentrations. Summer blooms appeared to show a positive correlation with increases in temperature and dissolved oxygen concentrations. Zooplankters were most abundant during the winter months at the Beaver Dam stations. Consequent net zooplankton decreases appeared to be inversely proportional to the average seasonal temperature. From July to October 1968, the Kings River stations showed a positive correlation of zooplankton number with seasonal increases in temperatures and decreases in average riffle speeds. (Auth.)

14686. Carter, W. R., III (State of Md. Fish & Wildl. Admn., Annapolis, Maryland). 1971. REMOVABLE HYDROFOILS WHICH PERMIT SURFACE AND BOTTOM SAMPLING WITH A SINGLE OTTER TRAWL. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 646-648.

A rapidly installable and removable hydrofoil permits a single otter trawl to be used for both surface and bottom sampling. The hydrofoil is airplane-wing shaped in cross section and is three feet long, ten inches wide with a two inch maximum thickness. It is mounted on a fifteen degree wedge and secured to the top edge of each otter board. Conversion of doors from one mode of sampling to the other can be done in about one minute. (From auth.)

14687. Fatora, Joseph R. (Ga. Game and Fish Comm., Lake Burton Hatchery, Clarkesville, Georgia). 1971. NOONTOOTLA - A SIXTEEN-YEAR CREEL AND USE HISTORY OF A SOUTHERN APPALACHIAN TROUT STREAM UNDER CHANGING MANAGEMENT REGULATIONS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 622-637.

Sixteen years of creel and use data on Noontootla Creek in the southern Appalachian mountains of northern Georgia from 1954 to 1969 are presented. Changes in fishing pressure, catch rates, and use patterns under three types of management regulations - general regulations from 1954-1963 except for 1960 when the stream was designated "artificials only", and "artificials only catch-and-release" regulations from 1964-1969 - are discussed. Noontootla is a wildlife management area stream fished under a permit check in-check out system allowing a nearly complete survey. A total of 17,445 anglers were surveyed. The survey revealed a decrease in daily fishing pressure under "artificials only" regulations and a substantial decrease under "catch-and-release" regulations. The use data revealed a decrease in hours/mean angler day with increasingly restrictive regulations: 4.62, 3.70, and 3.26 for general "artificials only", and "catch-and-release", respectively. Anglers catching at least one fish fished on the average longer than unsuccessful anglers. Throughout the survey period successful anglers fished 1.7 hours longer per angler day than unsuccessful anglers. Success - catching at least one fish - averaged 71.1 percent for the survey period, slightly less (64.1 percent) under "catch-and-release" regulations than general regulations (72.2 percent). However, successful anglers averaged 6.6 fish/trip under "catch-and-release" regulations and 5.1 under general regulations. After initiation of "catch-and-release" regulations and drastic reduction in stocking intensity, natural reproduction and stocking carryover were sufficient to sustain a high catch rate. Associated with the decrease in hours/angler day with increasingly restrictive regulations, the catch/hour for successful anglers increased from 1.0 to 1.7. No distinct use patterns were evident other than differences in angling pressure on the four days of the week the stream was open. The majority of angler use after "catch-and-release" regulations were initiated was from urban anglers. Stocking rate and creel-return of stocked fish, type of lure or bait used, and length frequencies of stream-reared fish brought to creel are discussed. Of the anglers responding to a questionnaire in 1969, 79.8 percent preferred the "catch-and-release" concept as it was or with slight modifications. (Auth.)

14688. Liang, J. K., and R. T. Lovell (Dept. of Fish. and Allied Aquacultures, Auburn Univ., Auburn, Alabama). 1971. BIOLOGICAL EVALUATION OF AQUATIC PLANTS AS POTENTIAL INGREDIENTS IN SUPPLEMENTAL FEEDS FOR CHANNEL CATFISH. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 638-645.

A series of feeding trials were conducted in raceway-type aquariums with semi-purified diets for the purpose of biologically evaluating aquatic plants as diet ingredients for channel catfish. A protein concentrate extracted from water hyacinth was compared with casein for protein efficiency ratio (PER) with channel catfish fingerlings. The possibility that growth factors may be contributed by small amounts of dehydrated aquatic plant meal in the diet was tested by adding 5 or 10% water hyacinth meal or alfalfa meal to vitamin-free and vitamin-sufficient purified diets and to commercial-type diet formulations. Weight gains and mortalities were used as criteria for evaluating the experimental diets. The lengths of the feeding trials were 4 to 8 weeks depending upon the responses of the fish to the treatments. The PER (g gain per g protein fed) for the water hyacinth protein, 0.34, was much lower than that for casein, 4.87. Both hyacinth meal and alfalfa meal improved fish growth when added to vitamin-free diets but not when added to vitamin-sufficient diets. Water hyacinth meal provided significantly higher weight gains and lower mortalities than did commercial alfalfa meal when fed in vitamin-free diets. Water hyacinth meal did not improve the growth of fish when the plant meal was fed as 10% of commercial-type diets. The most feasible nutritional contribution of water hyacinth to channel catfish nutrition appears to be the supplementation of growth factors, when fed at low percentages, in vitamin-poor diets. (Authors)

14689. Tafanelli, R., P. E. Mauck, and G. Mensinger (Okla. Coop. Fish. Unit, Okla. State Univ., Stillwater, Oklahoma). 1971. FOOD HABITS OF BIGMOUTH AND SMALLMOUTH BUFFALO FROM FOUR OKLAHOMA RESERVOIRS. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 649-658.

The results of this study seem to corroborate the findings of other authors even though there is considerable variation in the details. The general conclusions reached are: Smallmouth buffalo in the reservoirs studied are bottom feeders while bigmouth buffalo are more pelagic feeders. The major food category of smallmouth buffalo was organic detritus. The major food category of bigmouth buffalo was organic detritus, except for occasional winter and spring months. The major identifiable food items in the diet of both species were Copepoda and Cladocera. This was more evident in bigmouth buffalo while smallmouth buffalo also utilized relatively greater amounts of Chironomidae and Ostracoda. A slight seasonal variation in diet occurred for both species which showed more plankton in spring and fall and a greater volume of stomach contents during cooler months. Average stomach volume for both species was lowest in Grand Reservoir. Smallmouth buffalo stomachs had lower numbers of food items in most categories. Cladocerans appeared in the diet of bigmouth buffalo earliest in the southernmost reservoir and last in the northernmost reservoir. (Authors conclusions)

14690. Grant, George C., Victor G. Burrell, Jr., and William H. Kriete, Jr. (Va. Inst. of Marine Science, Gloucester Point, Virginia). 1971. AGE COMPOSITION AND MAGNITUDE OF STRIPED BASS WINTER GILL-NET CATCHES IN THE RAPPAHANNOCK RIVER, 1967-1970. Proc. of the 24th Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Sept. 27-30, 1970, pp. 659-667.

The dependence of commercial fishing success on strong yearclasses of striped bass is demonstrated, using four years of catch records from a small group of cooperating gill-net fishermen. Age analysis of these Rappahannock River catches during 1969 and 1970 revealed that an approximate tripling of landings in 1970 was a result of selection for the dominant 1966 year-class. (Authors)

14691. Rosen, Moe Wm., and Neri E. Cornford (Naval Undersea Res. and Dev. Center, Pasadena Lab., Pasadena, California). 1971. FLUID FRICTION OF FISH SLIMES. Nature, 234(5323): 49-51; Comm. Fish. Abstr., 25(2): p. 30.

The researchers tested by means of a portable rheometer, the capacity of the natural slime of fishes to affect the friction of water. Calico kelp bass, California bonito, California halibut, Pacific barracuda, and sand bass (salt-water species) and bluegill, German brown trout, Kamloops rainbow trout, smallmouth bass, and white crappie (fresh-water species) were examined. The natural slimes, dissolved in water, of most of the fishes (California bonito was the exception) had a remarkable capacity to decrease greatly the friction of water when flowing in the turbulent state. The slime of the Pacific barracuda was the most effective of all the fish examined with a maximum reduction of 65.9% (compared with ocean water) when the natural slime was at a 5% concentration. Reductions of 57% to 63% were frequently obtained with the slimes of other species. The authors believe that the slimes of many (but not all) fishes assist in locomotion by reducing the drag (resistance) which water offers to their bodies.

14692. Sargent, M., D. Blazek, J. H. Elder, C. A. Lembi, and D. J. Morre (Purdue Univ., Lafayette, Indiana). 1970. THE TOXICITY OF 2, 4-D AND PICLORAM HERBICIDES TO FISH. Tech. Paper JHRP-24, 25 p.; Govt. Res. Announcements 71(17): 61, Sept. 1971; Comm. Fish. Abstr. 25(2): p. 36.

Two common herbicides, picloram or Tordon (4-amino-3, 5, 6-trichloropicolinic acid) and 2, 4-D (2, 4-dichlorophenoxyacetic acid) and their salts exhibit low toxicity to fish. (Authors abstract in part)

14693. Dunbar, Clarence E., and Roger Lee Herman (Bur. Sport Fish. and Wildl., Eastern Fish Disease Lab., Kearneysville, West Virginia). 1971. VISCERAL GRANULOMA IN BROOK TROUT (Salvelinus fontinalis). J. Nutr., 101(11): 1445-1451; Comm. Fish. Abstr., 25(2): p. 32, 1972.

Visceral granuloma is a chronic inflammatory disease that affects, primarily, the anterior stomach and posterior kidney of the brook trout. It appears to be a disease of cultured trout. In these experiments, the researchers fed brook trout (1) a synthetic diet with suspect test diet components added and (2) a meat-meal diet with individual diet components removed to determine their effect on the incidence of visceral granuloma. Deletion of cottonseed meal from a granuloma-producing diet resulted in a very low incidence of the disease; addition of cottonseed meal to a nongranuloma-producing diet resulted in a relatively high incidence of the disease. However, because a low incidence of the disease did occur in the absence of cottonseed meal, the meal cannot be considered as the sole factor in the cause of the disease. Apparently gossypol was not the causative agent. The authors concluded that visceral granuloma of the brook trout is diet-associated but the exact cause is not yet known. They suspect that the disease is an inflammatory response to some chemical irritant present in many of the diet components.

14694. Giovenco, Silvia, Ines Binotti, Marizio Brunori, and Eraldo Antonini (Inst. Biol. Chem., Univ. Rome, Rome, Italy). 1971. FUNCTIONAL PROPERTIES OF FISH HEMOGLOBINS. I. OXYGEN EQUILIBRIUM OF TROUT HEMOGLOBIN. Chem. Abstr., 74(9): 39857n; Comm. Fish. Abstr., 25(2): p. 40, 1972.

14695. Strand, J. A., W. L. Templeton, and E. G. Tangen (Battelle Mem. Inst., Richland, Washington). 1971. ACCUMULATION AND RETENTION OF TRITIUM (TRITIATED WATER) IN EMBRYO AND LARVAL FISH AND THE RADIATION EFFECT. AEC Report BNWL-SA-3711 (CONF-710501-16), 20 p. Available from National Technical Information Service, $3. paper copy; Selected Water Resources Abstracts, 5(2): p. 45.

Literature concerning the effect of tritium in nuclear-powerplant effluents on aquatic food chains is reviewed. In the present study artificially spawned rainbow trout eggs were exposed to spring water spiked with 0.01-10 microCi/ml of tritium. Tritium uptake reached equilibrium within 1-2 days. About 2% of the tritium was organically bound in the egg. Elution by free-flowing water could be approximately described by 1-2 and 17 day half-times. With exposure during embryogenesis in water spiked with 1 microCi/ml, the incidence of abnormal larvae and behavioral and physiological tests failed to show a radiation effect.

14696. Cushing, C. E., and D. G. Watson (Battelle Northwest Lab., Richland, Washington). 1971. CYCLING OF ZINC-65 IN A SIMPLE FOOD WEB. AEC Report BNWL-SA-3877 (CONF-710501-6), 12 p. Available from National Technical Information Service, $3. paper copy; Selected Water Resources Abstracts, 5(2): p. 45.

Passage of zinc-65 was followed through the periphyton-carp chain in four artificial streams spiked to 1 pCi/ml (two streams) or 10 pCi/ml (two streams). Light and current were uniform and water temperature, followed that of the Columbia River (about 6 to 18C from January to June, the period of the experiments). Fish and periphyton in the river served as controls. Equilibrium uptake of zinc-65 was reached in about 28 days in periphyton (17 and 90 nCi/g), and in 43 days in the fish (0.25 and 1.3 nCi/g), although with the fish the increase in metabolic activity with increasing water temperature was a complicating effect. Data is also given in terms of specific activities (35 and 210 pCi/mg total zinc for periphyton, 3 and 15 pCi/mg total zinc for carp).

14697. Suppes, V. Charles (Mo. Dept. of Conservation Blind Pony Hatchery, Marshall, Missouri). 1972. JAR INCUBATION OF CHANNEL CATFISH EGGS. Progr. Fish Cult., 34(1): 48.

14698. Kevern, Niles R. (Mich. State. Univ., Dept. of Fish. & Wildl., East Lansing, Michigan). 1971. EFFECTS OF LIMNOLOGICAL FACTORS ON UPTAKE OF CS-137 FALLOUT BY FISH. AEC Report COO-1795-3, 6 p. Available from National Technical Information Service, $3. paper copy; Selected Water Resources Abstracts, 5(2): p. 45.

Multiple regression analysis of data from 6 lakes gives for Cs-137 in 3-yr-old bass, pCi/g wet wt - 1.6 .. 6.8 (pCi/l of Cs-137 in water) - 0.056 (ng/l of stable Cs)- 0.38 (mg/l of K). Improvement would result from study of a larger number of lakes, and by development of a more sensitive analytical method for stable Cs (applicable to the 20-40 ppt range found in freshwater systems). The present paper summarizes some of the findings of COO-1795-1, -2, -6, and -7; and of the conference papers -4 and -5 (where the effects from parameters operating within fish populations are described in greater detail.

14699. Talbot, G. B., and Sven I. Johnson (Bur of Sport Fish. & Wildl., Tiburon Marine Lab., Tiburon, California). 1972. REARING PACIFIC HERRING IN THE LABORATORY. Progr. Fish Cult., 34(1): 2-7.

Pacific herring (Clupea harengus pallasi) eggs were obtained from adult herring and from natural spawning in San Francisco Bay. These were hatched and reared in the laboratory in running seawater to an age of 2 years. These fish obtained some food as plankton from the seawater pumped from San Francisco Bay, but at hatching were fed brine shrimp larvae and later live adult brine shrimp and commercially available frozen brine shrimp. Growth rate and development are described. (Authors)

14700. Dumas, Richard F., and James S. Brand (New York State Dept. of Environmental Conservation, Fish Path. Lab., Rome, New York). USE OF TANNIN SOLUTION IN WALLEYE AND CARP CULTURE. Progr. Fish Cult., 34(1): 7.

The use of tannin solution on walleye and carp eggs hastened water hardening, toughened shells, and prevented adhesion within and on incubation jars. This treatment was a great labor and time saver. (Authors)

14701. Caillouet, Charles W. (Univ. of Miami, Rosenstiel School of Marine and Atmospheric Sci., Miami, Florida). 1972. ROTABLE CAGE FOR HIGH-DENSITY AQUACULTURE. Progr. Fish Cult., 34(1): 8.

A cylindrical cage which can be rotated intermittently on its horizontal axle is described. The cage alleviates the problem of occlusion of its external meshes by fouling organisms. A portion of the cage is out of water and exposed to sunlight and drying and can be easily cleaned while the other portion is under water and contains the fish. (Auth.)

14702. Meyers, S. P., D. P. Butler, and W. H. Hastings (Dept. of Food Sci., La. State Univ., Baton Rouge, Louisiana). 1972. ALGINATES AS BINDERS FOR CRUSTACEAN RATIONS. Progr. Fish Cult., 34(1): 9-12.

Sodium alginate, added to various feed formulations at 0.75% to 3%, is an effective binder for crustacean rations, affording pellet durability as long as 48 hours under tank-test conditions. Use of a stable ration is necessary for slow feeding animals such as shrimp and prawns. Advantages of using the alginate "system" as a binder include more efficient conversion rates, reduced fouling of the water by destruction of the feed, and concurrent reduction in overall microbial buildup in the crustacean growing area. (Authors)

14703. Sanders, J. E., J. L. Fryer, D. A. Leith, and K. D. Moore (Dept. of Microbiol., Oregon State Univ., Corvallis, Oregon). 1972. CONTROL OF THE INFECTIOUS PROTOZOAN Ceratomyxa shasta BY TREATING HATCHERY WATER SUPPLIES. Progr. Fish Cult., 34(1): 13-17.

Selected water treatment systems were tested to determine if they would remove or destroy the infective stage of Ceratomyxa shasta in fish hatchery water supplies. Reduction in the number of mortalities occurred in juvenile rainbow (steelhead) trout (Salmo gairdneri) exposed to Deschutes River water treated by

MicroFLOC filtration, MicroFLOC filtration and chlorination, and ultraviolet irradiation (UV). The effectiveness of UV irradiation can probably be attributed to the very low turbidity levels of Deschutes River water. High-rate sand filtration of Columbia River water had no detectable effect on the number of C. shasta infections in juvenile coho salmon (Oncorhynchus kisutch); however, high-rate sand filtration plus UV irradiation greatly reduced the incidence of this disease. Exposure times necessary for contracting C. shasta were investigated by holding juvenile coho salmon in untreated Columbia River water at different intervals. These experiments suggest that infections caused by this parasite may occur during 30 minutes exposure to untreated Columbia River water. These observations indicate the necessity for continuous treatment of the incoming water supply. (Authors)

14704. Brauhn, James L. (Bur Sport Fish. & Wildl., Fish-Pesticide Res. Lab., Columbia, Missouri). 1972. A SUGGESTED METHOD FOR SEXING BLUEGILLS. Progr. Fish Cult., 34(1): 17.

Criteria used for separating male bluegill (Lepomis macrochirus) from females include the coloration and length of opercular tabs, coloration of the gular or throat area, pigmentation of the urogenital region, and the size and shape of genital pores. These have been separated from populations of mixed sexes with 90% to 99% accuracy. (Auth.)

14705. Ross, A. J. (Bur. Sport Fish. & Wildl., Western Fish Disease Lab., Seattle, Washington). 1972. In Vitro STUDIES WITH NIFURPIRINOL (P-7138) AND BACTERIAL FISH PATHOGENS. Progr. Fish Cult., 34(1): 18-20.

Nifurpirinol (P-7138) was tested on some strains of Chondrococcus columnaris and Cytophaga psychrophila and on 10 strains each of Aeromonas salmonicida, A. liquefaciens, Vibrio spp., Pseudomonas spp., and redmouth bacterium. Tests were conducted at concentrations of 0.19, 0.39, 0.78, 1.5, 3.1, 6.2, and 12.5 micrograms of drug per milliliter of culture medium. The minimum inhibitory concentrations (MIC) for the C. columnaris strains were lower than those for C. psychrophila. While A. salmonicida cultures showed a response comparable to the two myxobacteria, the other organisms tested, particularly the Pseudomonas spp., had higher MIC's than those reported by Japanese workers of 0.1 to 0.3 μg/ml. Only two of the A. salmonicida cultures were not inhibited by 0.78 μg/ml of nifurpirinol, while all of the Pseudomonas cultures and six of the Vibrio cultures grew at concentrations of 12.5 μg/ml of drug. The A. liquefaciens and redmouth bacterium cultures were intermediate in their reactions, as only one strain of the former grew at 3.1 μg/ml of drug and only six of the latter grew at that concentration. All cultures were inhibited by 6.2 μg/ml of nifurpirinol.

14706. Leteux, Frank, and Fred P. Meyer (Ozark Fisheries, Inc., Stoutland, Missouri). 1972. MIXTURES OF MALACHITE GREEN AND FORMALIN FOR CONTROLLING Ichthyophthirius AND OTHER PROTOZOAN PARASITES OF FISH. Progr. Fish Cult., 34(1): 21-26.

Fish infected with protozoan parasites were treated with mixtures of malachite green and formalin. Laboratory tests suggested that mixtures of 0.05 ppm malachite green plus 15 ppm, 25 ppm, or 50 ppm formalin were safe and effective in treating external protozoans and ichthyophthirii on channel catfish (Ictalurus punctatus) and that levels up to 0.2 ppm malachite green plus 33 ppm formalin could be used on goldfish (Carassius auratus). In field trials, in tanks and ponds, a treatment of 0.01 ppm malachite green with 24 ppm formalin provided excellent control of Costia, Trichodina, Chilodonella, Scyphidia, and Trichophrya in all cases after one application. With two exceptions, Ichthyophthirius was controlled by three applications on alternate days. Cleidodiscus was not affected by the treatments. In nearly all cases, Ichthyophthirius-infected fish showed marked improvement within 12 hr after the first application. Other external protozoans were greatly reduced and usually eradicated by the first treatment. Eradication of Ichthyophthirius was usually achieved after the second application. Under field conditions three treatments were used as a precaution to ensure successful control. The malachite green and formalin mixture proved effective against Costia in a single application.

14707. Marking, Leif L. (Bur. Sport Fish. & Wildl., Fish Control Lab., La Crosse, Wisconsin). 1972. SENSITIVITY OF THE WHITE AMUR TO FISH TOXICANTS. Progr. Fish Cult., 34(1): 26.

White amur (Ctenopharyngodon idellus) were exposed to several registered fish toxicants and candidate fish toxicants in laboratory bioassays at 17° C. The 96-hr LC50's (concentrations producing 50% mortality) in parts per billion of the chemicals are as follows: antimycin (Fintrol technical) 0.255; Salicylanilide I (experimental) 8.59; juglone (experimental) 43.5; rotenone (Noxfish) 63; and Bayluscide, 141. Additional bioassays showed that antimycin and Noxfish are also effective against white amur in waters of different hardness and temperature. The results suggest that the white amur is approximately as sensitive as the common carp (Cyprinus carpio) to these chemicals, and chemical control of undesired populations is feasible.

14708. Huish, Melvin T. (School of Forest Resources, Univ. of Ga., Athens, Georgia). 1972. SOME RESPONSES OF THE BROWN BULLHEAD TO MS-222. Progr. Fish Cult., 34(1): 27-32.

Tests were conducted with MS-222 at five temperatures, four concentrations, and three sizes of Ictalurus nebulosus. Concentrations of 100 and 75 ppm produced a rapid immobilization of all size classes of brown bullhead. Time to induce anesthesia with the concentrations used was not greatly affected by temperatures. Recovery rates of the fish which were exposed for 1 hr were more rapid and mortalities less at temperatures of 7°, 12°, and 17° C. than those exposed to similar concentrations at temperatures of 22° and 27° C. (Auth.)

14709. Poluhowich, John J., and Robert P. Parks (Dept. of Biol., Univ. of Bridgeport, Bridgeport, Connecticut). 1972. A COMPARATIVE STUDY OF BLOOD CHEMISTRY AND RESPIRATION IN MARINE AND FRESHWATER EELS. Progr. Fish Cult., 34(1): 33-38.

A comparison of certain blood parameters and respiratory rates of the common Americal eel, Anguilla rostrata, were made for eels from marine and freshwater environments and for a limited number of eels from brackish water. The data show increased levels of cholesterol, calcium, chloride, total protein, hematocrit, osmotic pressure, and hemoglobin in marine eels. Glucose and pH were slightly higher in freshwater eels. Starch gel electrophoresis did not reveal specific changes in the plasma proteins resulting from habitation in the marine or freshwater environments. A green pigment is present in the plasma of the American eel which exhibits absorption maxima at 399 and 411 millimicrons. Oxygen consumption and respiration rates were greater in the freshwater eels. (Authors)

14710. Miller, Roy W. (Bur. Sport Fish. & Wildl., N. Y. Coop. Fish. Unit, Cornell Univ., Ithaca, New York). 1972. THREE METHODS FOR DETERMINING DISSOLVED OXYGEN CONCENTRATIONS NEAR FISH EMBRYOS. Progr. Fish Cult., 34(1): 39-42.

A micro-Winkler method and two probes (a Beckman Macro Electrode, and a Yellow Springs Instruments probe specially modified for field use) were tested for their suitability in measuring dissolved oxygen concentrations adjacent to fish embryos. It was required that the method not disturb oxygen depletion zones created by the respiring embryos. The micro-Winkler method made a minimal disturbance since only 1- to 1.5-ml water samples were used, but the readings were 3% to 15% below the Winkler readings used as standards. The Beckman Macro Electrode required only 5 mm/sec movement of the probe tip to achieve best accuracy (0.3 ppm mean deviation from the standard values) when used in the laboratory. The field probe was automatically temperature-compensated and highly portable but required 10 cm/sec movement of the probe tip to achieve accuracy matching the Beckman instrument. (Auth.)

14711. Berinati, D. J., and G. J. Crowley (Bur. Sport Fish. & Wildl., Sierra Nevada Aquatic Research Lab., Bishop, California). 1972. BLOOD SAMPLE PRESERVATION FOR HEMOGLOBIN ASSAY. Progr. Fish Cult., 34(1): 63-64.

14712. Galat, David L. (Bur. Sport Fish. & Wildl., N. Y. Coop. Fish. Unit, Cornell Univ., Ithaca, New York). 1972. PREPARING TELEOST EMBRYOS FOR STUDY. Progr. Fish Cult., 34(1): 43-48.

This paper describes methods of preparing teleost embryos for study. Eggs and embryos should be handled with pipettes or modified insect forceps. Satisfactory media for fixing and preserving include Stockard's corrosive-acetic, Bau's, Perenyi's, Bouin's, or 10% formalin. Clearing whole eggs by the essential oils or their synthetics, or by the hydrocarbons xylene, benzene, toluene, butanol, or isopropanol proved unsatisfactory. Glycerine cleared embryos very well with minimal embryo damage. Limited success was achieved in staining eggs with their chorions intact; it is usually best to remove the chorion prior to staining. A 10% bleach solution softens the chorion and makes it easier to remove. Hematoxylins are the most widely used embryological stains; Harris' is preferred. Stained embryo sections may be prepared by a paraffin sectioning method, and stained dissected whole-mounts by similar procedures to those used for dissected chick embryos. (Auth.)

14713. Hurley, Donal A. (Res. Branch, Ont. Dept. of Lands and Forests, Maple, Ontario, Canada). 1972. OBSERVATIONS ON INCUBATING WALLEYE EGGS. Progr. Fish Cult., 34(1): 49-54.

Careful records were kept of the percent fertilization and hatching success of samples of eggs from 28 female walleye in 1969 and 26 female walleye in 1970. The results showed a variable percentage fertilization between 10% and 100% in 1969 and between 65% and 97% in 1970. In 1969 the eggs were mudded at fertilization while in 1970 they were not. In both years about 46% to 48% of the original number of eggs hatched. The eggs were eyed at 274 thermal units (day-degrees Fahrenheit), median hatch occurred at 440 thermal units, and yolk absorption was complete at 690 thermal units. (Auth.)

14714. Taub, Stephen H. (Bur. of Sport Fish. & Wildl., Ohio Coop. Fish. Unit, Ohio State Univ., Columbus, Ohio). 1972. EXPLOITATION OF CRAYFISH BY LARGEMOUTH BASS IN A SMALL OHIO POND. Progr. Fish Cult., 34(1): 55-58.

Largemouth bass, Micropterus salmoides, were stocked in a 1 ha, unfished pond in October 1967. No fish were in this pond prior to stocking; however, a large population of burrowing crayfish, Cambarus diogenes, existed. The purpose of this study was (1) to determine growth rates of bass using mainly crayfish for forage and (2) to determine the extent of bass exploitation of the crayfish population. A population estimate of crayfish in October 1967, revealed 37,000 per ha. In less than 1 year after the largemouth bass introduction, not enough crayfish could be captured to make further population estimates. Bass increased in mean total length from 70 mm at time of stocking to 206 mm in October 1968, and to 259 mm in October 1969. Analyses of bass stomach contents revealed intensive utilization of crayfish in 1968 and moderate use in 1969. This study demonstrates that in the absence of other prey fish, largemouth bass will intensively exploit a burrowing crayfish population in a small pond. (Auth.)

14715. Bahr, Thomas G. (Inst. of Water Research, Mich. State Univ., East Lansing, Michigan). 1972. RECORDING ELECTRICAL ACTIVITY FROM THE LATERAL-LINE NERVE IN TROUT. Progr. Fish Cult., 34(1): 59-61.

A flanged glass nerve chamber was developed to record electrical activity from the lateral-line nerve in trout. Insertion of the chamber requires very little surgical manipulation and with little practice can be done in about 5 min. The nerve chamber excludes water from the recording electrodes enabling the fish to be completely covered with water while recording. Both spontaneous and evoked neural activity recorded using this technique remains stable as long as 3 days and provides a convenient base line against which to analyze effects of neurotoxic compounds to fish. (Auth.)

14716. Cook, David W. (Microbiol. Section, Gulf Coast Research Lab., Ocean Springs, Mississippi). 1972. A CIRCULATING SEAWATER SYSTEM FOR EXPERIMENTAL STUDIES WITH CRABS. Progr. Fish Cult., 34(1): 61-62.

This system was designed for holding large numbers of blue crabs for extended periods of time. Because of the low initial cost, the simplicity of construction, and the minimum amount of maintenance required, workers may be interested in using this system in their experimental studies. At about $33. one "six stack" system can be constructed which is capable of holding in separate compartments, 12 to 36 crabs depending on size. (Auth.)

14717. Pimentel, David (Dept. of Entom. and Limnol., Cornell Univ., Ithaca, New York). 1971. ECOLOGICAL EFFECTS OF PESTICIDES ON NON-TARGET SPECIES. Executive Office of the President, Office of Science and Technology, 220 p. Available from Supt. of Documents, U.S. Govt. Printing Office, Washington, D. C., price $2.00.

Ecological Effects of Pesticides on Non-target Species is a comprehensive compilation of published data. It is published by the Office of Science and Technology as received from the author in the belief that it will be a very useful contribution to the public discussion of pesticides. Contents include: Introduction; Insecticides; Herbicides; Fungicides; Pesticide Residues in the Environment; and An Evaluation and Summary.

14718. Benville, P. E., Jr., and R. C. Tindle (Bur. Sport Fish. & Wildl., Fish Pesticide Research Lab., Columbia, Missouri). 1970. DRY ICE HOMOGENIZATION PROCEDURE FOR FISH SAMPLES IN PESTICIDE RESIDUE ANALYSIS. J. Agric. Fd. Chem., 18(5): 948-949; Selected Water Resources Abstracts, 4(22): 24.

Fish samples to be used in pesticide residue analyses can be more easily homogenized by the following procedure. Section the frozen fish into pieces 1/2 x 1/2 x 1 inch. Break the dry ice into 1/2 inch chunks and add an amount equal to or exceeding the weight of the fish sample to a blender. Pulverize the dry ice and the sample in the blender until a fine powder is formed. Pour the pulverized mixture in a plastic bag, close with a rubber band, and place in a freezer and allow 7 hours for the dry ice to sublimate. This method has proved simpler and just as effective as methods employing desiccants.

14719. Morgenthaler, L. P. (Dept. of Chem., Georgetown Univ., Washington, D. C.). 1970. THE DETERMINATION OF TRACE QUANTITIES OF MERCURY BY ATOMIC ABSORPTION SPECTROMETRY. MPI Applications Notes, 5(5): 25-32; Selected Water Resources Abstracts, 4(22): 33, 1971.

A rapid and simple atomic absorption spectrometry technique is described for the determination of trace quantities of mercury. In this method, the mercury is reduced in aqueous solution (usually containing at least 1 M H_2SO_4) with tin (II) and sometimes with NH_2OH. A stream of air bubbled through this solution carries the mercury vapor through a drying tube filled with $Mg(ClO_4)_2$, and then into a flow-through absorption cell. The cell is positioned between a low-pressure mercury vapor lamp and a monochromator that measures the 2357 angstrom radiation of the lamp. This method assumes that the maximum vapor pressure of mercury in the absorption tube is proportioned to the total quantity of mercury present in the original solution. This assumption is experimentally verifiable.

14720. Bodien, Danforth G. (Fed. Wat. Qual. Admn., Northwest Region, Portland, Oregon). 1971. AN EVALUATION OF SALMONID HATCHERY WASTES. Report, Oct. 1971, 51 p.; Selected Water Resources Abstracts, 4(22): 45.

At present, 114 government fish hatcheries and numerous private hatcheries are operating in the northwestern United States. Most cause no problem, but during low summer river flows, some hatchery wastes create nuisance conditions in receiving waters. The objectives of this study were to quantitate and characterize these wastes, to determine their effects and to recommend control measures where necessary. It is recommended that water pollution control measures be considered for new hatcheries and at existing hatcheries on a priority basis.

14721. Becker, C. D. (Battelle Mem. Inst., Northwest Labs., Richland, Washington). 1971. FOOD AND FEEDING OF JUVENILE CHINOOK SALMON IN THE CENTRAL COLUMBIA RIVER IN RELATION TO THERMAL DISCHARGES AND OTHER ENVIRONMENTAL FEATURES. BNWL-1528, UC-48, Jan. 1971, 68 p.; Selected Water Resources Abstracts, 4(22): 45.

The relationship of thermal discharges from Hanford reactors to food and feeding of juvenile chinook salmon (Oncorhynchus tshawytscha) in the central Columbia River, Washington was studied in 1968 and 1969. The primary objectives were to (1) evaluate the food composition and feeding activities of the fish and (2) determine if heated effluents influenced their welfare. Environmental conditions, i.e. seasonal changes in river temperatures and flow volumes, relative to thermal requirements of young chinook, are detailed. Data on food organisms utilized by the fish are presented for 1968 and 1969, whereas analyses for possible thermal effects are based on the more extensive 1969 data. No consistent differences attributable to thermal increments were evident. The lack of detectable effects is apparently due to the fact that the main discharge plumes occur in midriver and the effluents are well mixed before reaching inshore feeding areas.

14722. Sharp, R. W. (Bur. Sport Fish. & Wildl., Fort Snelling, Minnesota). ROAD SALT AS A POLLUTING ELEMENT. In: Street Salting - Urban Water Qual. Workshop Proceedings, State Univ. Coll. of Forestry at Syracuse Univ., May 6, 1971: Syracuse, N.Y., State Coll. of Forestry, p 70-73, July, 1971; Selected Water Resources Abstracts, 4(24): 54.

The use of salt for snow and ice control on northern streets and highways has grown rapidly since the 1940's. In the winter of 1964-65, the City of Milwaukee, Wisconsin, used 33,000 tons of sodium chloride and 200 tons of calcium chloride. In the same winter, the Wisconsin Highway Department used 160,000 tons of sodium chloride, or 15.8 tons per mile of highway. The chlorides, being highly soluble, are carried by runoff water to lakes and streams. The question arises as to possible damage to the aquatic and terrestrial environment. Environmental effects appear to be localized near large urban centers and along heavily used freeway routes. Diamond Lake, in Hennepin County, Wisconsin, which receives the discharge of a major storm sewer, now has a chloride content of 2,270 ppm, equivalent of 3,780 ppm sodium chloride. To place these values in the perspective of fish tolerance, bluegills will tolerate 10,000 ppm, sodium chloride. Rainbow trout sustained 20% mortality at 12,000 ppm. A build-up of sodium chloride can cause complete soil sterility. Studies show a substantial build-up in chloride content of domestic wells located adjacent to main highway systems. Chloride levels exceeding the potable water supply standard of 250 ppm have been found in many states during recent years as a result of road salt application.

14723. Toole, Joe E. (Texas Parks & Wildl. Dept., Marshall, Texas). 1971. FOOD STUDY OF THE BOWFIN AND GARS IN EASTERN TEXAS. Texas Parks and Wildlife Dept. Technical Series No. 6, 35 p.

During the five year period of this study, 1,514 gar and bowfin stomachs were collected and examined. Spotted gar (Lepisosteus oculatus), alligator gar (L. spatula), longnose gar (L. osseus) and bowfin (Amia calva) were evaluated as predator species in the waters of east Texas. Insufficient data were compiled for the shortnose gar (L. platostomus) to determine its value as a predator of forage fish. Data analysis indicates the alligator and longnose gar are more specific forage fish predators than the spotted gar or the bowfin. All of the species studied consumed higher percentages of forage fish in given waters than can be attributed to non-selective feeding habits dependent only on food availability. (Auth.)

14724. Andrews, Austin K. (Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, Colorado). 1972. SURVIVAL AND MARK RETENTION OF A SMALL CYPRINID MARKED WITH FLUORESCENT PIGMENTS. Trans. Amer. Fish. Soc., 101(1): 128-133.

Use of fluorescent granular pigments exhibits great potential for marking cyprinids because of excellent longevity of properly applied marks.

14725. Burns, James W. (Calif. Dept. of Fish and Game, Sacramento, California). 1972. SOME EFFECTS OF LOGGING AND ASSOCIATED ROAD CONSTRUCTION ON NORTHERN CALIFORNIA STREAMS. Trans. Amer. Fish. Soc., 101(1): 1-17.

The effects of logging and associated road construction on four California trout and salmon streams were investigated from 1966 through 1969. This study included measurements of streambed sedimentation, water quality, fish food abundance, and stream nursery capacity. Logging was found to be compatible with anadromous fish production when adequate attention was given to stream protection and channel clearance. The carrying capacities for juvenile salmonids of some stream sections were increased when high temperatures, low dissolved oxygen concentrations, and adverse sedimentation did not accompany the logging. Extensive use of bulldozers on steep slopes for road building and in stream channels during debris removal caused excessive streambed sedimentation in narrow streams. Sustained logging prolonged adverse conditions in one stream and delayed stream recovery. Other aspects of logging on anadromous fish production on the Pacific Coast are discussed. (Auth.)

14726. Stauffer, Thomas M. (Mich. Dept. of Natural Resources, Marquette Fish. Res. Sta., Marquette, Michigan). 1972. AGE, GROWTH, AND DOWNSTREAM MIGRATION OF JUVENILE RAINBOW TROUT IN A LAKE MICHIGAN TRIBUTARY. Trans. Amer. Fish. Soc., 101(1): 18-28.

Juvenile rainbow trout were examined during 1951-59 while in stream nursery areas and when migrating downstream. Their body-scale relationship was: total length (mm) = 4.06 + 2.10 scale radius (mm x 107) and relationship between length (mm) and weight (g) was $W = 0.00001384L^{3.0426}$. Age composition of trout during autumn in the nursery areas averaged 68% age 0, 29% age I and 3% age II; trout in the downstream migration averaged 64% age I, 34% age II and 2% age III. Most downstream migration occurred between 21 May and 30 June, at night, on subsiding water levels and at water temperatures of 9-17 C. There was an association between numbers of juveniles in the nursery areas and numbers of subsequent downstream migrants. Trout grew about 76 mm per year; growth was similar to that in other Great Lakes tributaries and to growth in Pacific Ocean tributaries. Most downstream migrants in Great Lakes tributaries were age II or less, while in Pacific Ocean tributaries, most were age II and III. Time of migration was about the same in Great Lakes tributaries as in Pacific Ocean tributaries. (Auth.)

14727. Southward, G. Morris, and John Douglas (Internat. Pacific Halibut Comm., Seattle, Washington). 1972. EVALUATION OF A WINTER STEELHEAD FISHERY ON A WESTERN WASHINGTON RIVER. Trans. Amer. Fish. Soc., 101(1): 29-34.

Estimates were made of the sport catches of adult steelhead (Salmo gairdneri) in the North Fork of the Stillaguamish River for the winters of 1962-63 (20,000 fishermen) and 1963-64 (11,600 fishermen). Average catch per fisherman was 0.25 fish per day in the first season and 0.35 in the second. Total catches were approximately 5,000 and 4,000 steelhead, respectively. Releases from semi-natural rearing ponds made up nearly 34% of the 1963-64 catch, while hatchery releases were about 18% of the 1963-64 catch. (Authors)

14728. Abbott, Robert Riley (Fish. Res. Inst., Coll. of Fisheries, Univ. of Wash., Seattle, Washington). 1972. INDUCED AGGREGATION OF POND-REARED RAINBOW TROUT (Salmo gairdneri) THROUGH ACOUSTIC CONDITIONING. Trans. Amer. Fish. Soc., 101(1): 35-43.

About 90% of the rainbow trout (Salmo gairdneri) roaming freely in a large pond were conditioned to come to feed at the source of an underwater acoustic stimulus in about 45 trials. The stimulus was a 150-Hz, pure tone broadcasted continuously for one minute before and throughout feeding. The fish showed no tendency to discriminate between the conditioning tone and a 300-Hz tone produced in tests from the same sound source. (Auth.)

14729. McCleave, James D., and George W. LaBar (Dept. of Zool., Univ. of Maine, Orono, Maine). 1972. FURTHER ULTRASONIC TRACKING AND TAGGING STUDIES OF HOMING CUTTHROAT TROUT (Salmo clarki) IN YELLOWSTONE LAKE. Trans. Amer. Fish. Soc., 101(1): 44-54.

Ultrasonic tracking of mature cutthroat trout (Salmo clarki) from Little Thumb Creek displaced to the open water of Yellowstone Lake in 1969 suggested, but did not conclusively demonstrate, that trout from the west side of the lake have a westward compass mechanism, similar to the eastward compass mechanism of east side trout. Anosmic trout from Clear Creek made variable movements, but some exhibited the same patterns as control trout and homed. Experimental trout and control trout from Clear Creek retained prior to ultrasonic tracking under a 6 hr early photoperiod and a normal photoperiod, respectively, exhibited similar movements, most of which were eastward or southeastward as is typical of Clear Creek trout. Either they do not use a time-compensated sun compass mechanism or we were unsuccessful in shifting the biological clock. Cloud cover apparently did not alter fish movement patterns. Half (49.5%) of 299 mature Clear Creek trout tagged and displaced to five release points homed. One third of each release group was blinded, one third made anosmic, and one third anesthetized only. Significantly fewer blind trout and insignificantly fewer anosmic trout homed than control trout. Blind trout were significantly slower to home than anosmic or control trout. There was no correlation between homing percentage and distance displaced, but homing time generally increased with increasing distance (except for those released just below the fish trap as a control). (Authors)

14730. Wagner, Wilbert C. (Mich. Dept. of Nat. Res., Marquette Fish. Res. Sta., Marquette, Michigan). 1972. UTILIZATION OF ALEWIVES BY INSHORE PISCIVOROUS FISHES IN LAKE MICHIGAN. Trans. Amer. Fish. Soc., 101(1): 55-63.

The exotic alewife (Alosa pseudoharengus) has become exceedingly abundant in Lake Michigan. During May - August, they migrate to inshore waters to spawn and may provide an abundant food supply for the inshore warm-water piscivorous fishes. I examined stomach contents of 405 northern pike (Esox lucius), 112 smallmouth bass (Micropterus dolomieui), 103 walleye (Stizostedion vitreum vitreum), 43 burbot (Lota lota) and 29 bowfin (Amia calva) from Little Bay de Noc in Lake Michigan, during April - October of 1966-68 to determine their food habits when alewives were abundant and when alewives were scarce. Before alewives arrived in the spring, rainbow smelt (Osmerus mordax) were the most important prey species in the diets. When alewives were abundant, they provided large percentages of the total weight of foods eaten: northern pike - 66%, smallmouth bass - 60%, walleye - 71%, burbot - 100% and bowfin - 100%. After most alewives left in the fall, no single prey species predominated in the diets. Northern pike grew faster in Little Bay de Noc than in other waters, probably because they fed heavily on alewives and smelt. Northern pike and walleyes did not prey on the abundant yellow perch (Perca flavescens), a species upon which they normally feed, strongly suggesting that perch were buffered from these predators by the abundant alewives and smelt. (Auth.)

14731. Tsai, Chu-fa (Nat. Res. Inst., Univ. of Maryland, College Park, Maryland). 1972. LIFE HISTORY OF THE EASTERN JOHNNY DARTER, Etheostoma olmstedi Storer, IN COLD TAILWATER AND SEWAGE-POLLUTED WATER. Trans. Amer. Fish. Soc., 101(1): 80-88.

The life history of two populations of Etheostoma olmstedi Storer in the Patuxent River, Maryland, one in cold reservoir tailwater and the other in sewage-polluted water, was studied to determine the effects on this species of man-made modifications in the stream. The spawning season was in May and June with temperatures approximately 12.5-14.5 C in the cold tailwater and 16.0-18.5 C in the sewage-polluted water. In the sewage-polluted water, the fish grew faster in early summer of the first year than those in cold tailwater, but later on growth in length slowed down, even though the condition factor continued to increase. Fecundity in the sewage-polluted water population was larger than that in the

coldwater population because of larger body weight. In the sewage-polluted water, there were fewer males with a lower condition factor than females and had a higher percentage of fish in the II-year class and a lower percentage in the I-year class than the cold tailwater population. Males did not grow as fast as females in the cold tailwater. (Auth.)

14732. Martin, F. Douglas (Dept. of Zool., Indiana Univ., Bloomington, Indiana). 1972. FACTORS INFLUENCING LOCAL DISTRIBUTION OF Cyprinodon variegatus (PISCES: CYPRINODONTIDAE). Trans. Amer. Fish. Soc., 101(1): 89-93.

Local distribution of Cyprinodon variegatus Lacépède was examined with special emphasis on entrance into fresh water. One hundred and twenty localities were examined in relationship to fish faunas and water chemistry. The chemical factors examined were calcium, magnesium, sodium, potassium, chloride, alkalinity and dissolved oxygen. These factors singly or in combination had little effect on local distribution. Primary freshwater fish and especially centrarchid fishes seem to exclude Cyprinodon with the mechanism for this exclusion appearing to be competition for some resource(s). (Auth.)

14733. Andrews, James W., and Robert R. Stickney (Skidaway Inst. of Oceanogr., Savannah, Georgia). 1972. INTERACTIONS OF FEEDING RATES AND ENVIRONMENTAL TEMPERATURE ON GROWTH, FOOD CONVERSION, AND BODY COMPOSITION OF CHANNEL CATFISH. Trans. Amer. Fish. Soc., 101(1): 94-99.

Channel catfish (Ictalurus punctatus) fingerlings were maintained in 20-gallon glass aquaria at 18, 22, 26, 30 and 34 C. Duplicate groups at each temperature were fed 2, 4 and 6% of their biomass daily. After 12 weeks sample fish from each group were sacrificed and analyzed for total body lipid content and fatty acid composition. Highest gains and the best food conversion ratios were achieved at 30 C. Substantial gains were noted at 26 and 34 C with lesser growth at 18 and 22 C. At all temperatures a feeding rate of 4% of biomass daily was sufficient for rapid growth. An increase in environmental temperature from 18 to 34 C resulted in a near linear increase in lipid content from 23.8 to 43.6% of whole carcass. Arachidonic and docosahexaenoic acid levels increased with decreasing temperatures. (Authors)

14734. Marking, Leif L., and Verdel K. Dawson (Bur. Sport Fish. & Wildl., Fish Control Lab., La Crosse, Wisconsin). 1972. THE HALF-LIFE OF BIOLOGICAL ACTIVITY OF ANTIMYCIN DETERMINED BY FISH BIOASSAY. Trans. Amer. Fish. Soc., 101(1): 100-105.

The half-life of biological activity of antimycin, a powerful fish toxicant, was determined using fish bioassays at different test temperatures and pH's. The species exposed in decreasing order of sensitivity to the toxicant include rainbow trout, bluegill, green sunfish, goldfish, channel catfish, and black bullhead. Antimycin is deactivated more rapidly at higher temperatures, but the high temperatures did not influence the deactivation as greatly as high pH levels. The half-lifes at the different pH's are as follows: pH 6 and 6.5 = 310 hours, pH 7.5 = 120 hours, pH 8 = 100 hours, pH 8.5 = 46 hours, pH 9.0 = 9.7 hours, pH 9.5 = 4.6 hours, and pH 10 = 1.5 hours. (Authors)

14735. Plumb, John A. (Dept. of Fish. and Allied Aquacultures, Agr. Exp. Sta., Auburn Univ., Auburn, Alabama). 1972. A VIRUS-CAUSED EPIZOOTIC OF RAINBOW TROUT (Salmo gairdneri) IN MINNESOTA. Trans. Amer. Fish. Soc., 101(1): 121-123.

A highly communicable pathogen, with viral properties, was isolated from rainbow trout in Minnesota. It is clear that the pathogen is not IPN, but the nature of the pathogen in cell culture, its clinical signs in fish, its physical and biochemical characteristics, and its histopathology are similar to IHN virus. A clear distinction cannot be made between this virus and VHS. If, in fact, the virus under study is IHN, this report constitutes its first occurrence outside of the Pacific Northwest. (Auth. conclusions)

14736. Krupauer, V. 1968. EXPERIENCE GAINED IN THE REARING OF HERBIVOROUS FISH IN CZECHOSLOVAKIA. Buletin vyzk. Ust. ryb. Vodnany, 4(2): 3-15. (Bibl. 16; Cs, e; Vyzk. Ustav Rybar. Vodnany, Czechoslovakia); Weed Abstracts, 19(3): Abs. 1151, 1970.

Ctenopharyngodon idella, Aristichthys nobilis and Hypophthalmichthys molitrix were first successfully imported into Czechoslovakia in 1961 and importations continued until 1966. Transportation of fry and rearing of yearlings is described. The weed control effect of C. idella is not very marked until the second year of its life when stocking rates of 2000-3000/ha are effective; only 500 fish 2-3 years old are required per ha (1000 where overgrowth is excessive). Polycultures with common carp (Cyprinus carpio), reproduction and the effect of water temperature on feeding are discussed.

14737. Bobrova, Yu. P. 1968. THE DIET AND GROWTH OF GRASS CARP IN FISH FARM PONDS OF THE CENTRAL RUSSIAN REPUBLIC. In Nikol'skii, G.V., ed.: Novye Issled. Ekol. Razved. rast.-yadn. Ryb (New investigations in the ecology and breeding of herbivorous fish), Nauka, Moskva, 1968, 106-16. (Bibl. 16; R; Vses. n-i Inst. prud. ryb. Khoz., Moskva Zh-33, Khlebnikov per 9, USSR); Weed Abstracts, 20(2): Abs. 743, 1970.

The diet of Ctenopharyngodon idella was studied in ponds in the Moscow region in 1963-64 and in the Ryazan region in 1965. The fish fed most at a water temperature of $>$ 20°C and sporadically at $<$ 15-16°C. Grass carp yearlings, stocked at 1500/ha and given an adequate diet of vegetation, did not affect the growth of common carp (Cyprinus carpio) stocked with them at 3000/ha. Two-year old grass carp grew better in polycultures than in monocultures. Consumption by the grass carp of artificial foods intended for the common carp was compensated by the fertilizing effect of the grass carp faeces on pond organisms.

14738. Voropaev, N. V. 1968. MORPHOLOGICAL CHARACTERISTICS, DIET AND CERTAIN FISH FARMING ATTRIBUTES OF SILVER CARP AND BIGHEAD AND THEIR HYBRIDS. In Nikol'skii, G.V., ed.: Novye Issled. Ekol. Razved. rast.-yadn. Ryb (New investigations in the ecology and breeding of herbivorous fish), Nauka, Moskva, 1968, 206-17. (Bibl. 10; R; Vses. n-i Inst. prud. ryb. Khoz., Moskva Zh-33, Khlebnikov per. 9, USSR); Weed Abstracts, 20(2): Abs. 744, 1970.

Diet of Hypophthalmichthys molitrix and Aristichthys nobilis and their hybrids is considered to be a function of the "mesh size" of the water straining apparatus in the mouths of individual fish species and the size of plankton organisms present in the water; it increased little (from 20 to 25 μm) with growth to 2 kg in the case of H. molitrix whereas the "mesh size" of 20- to 2000-g A. nobilis increased with weight from 20 to 60 μm. The "mesh size" of hybrids increased from 20 to 40 μm with growth. A. nobilis had the largest filtration surface and H. molitrix the smallest. The "mesh size" of 6- to 7-g fish was about the same (20 μm) for all species; the diet was composed 60-70% of phytoplankton (Dinobryon sp. 54-66% and Planctococcus sp. 18%) and 30-40% of detritus. At a fish weight of 40-60 g, the diet of H. molitrix was composed 80% of phytoplankton (Scenedesmus 17%, Coelastrum 18%, Planctococcus 25% and Merismopedia 12%) and 20% of detritus whereas A. nobilis was only able to trap the larger forms of phytoplankton. When a "bloom" of large ($>$ 60 μm diam.) blue-green algae (Aphanizomenon sp., Microcystis pulverea and Coelosphaerium dubium) occurred in September 1965 they composed 95-97% of the diet of 3-year-old A. nobilis; the latter was also able to trap colonies of the smaller algae such as Dinobryon sp.

14739. Chittenden, Mark E., Jr. (Va. Inst. of Mar. Sci., Gloucester Point, Virginia). 1972. SALINITY TOLERANCE OF YOUNG BLUEBACK HERRING, Alosa aestivalis. Trans. Amer. Fish. Soc., 101(1): 123-125.

Experiments indicate that the blueback herring is highly salinity tolerant early in life. Euryhaline tolerance allows this species to occupy both saltwater and freshwater nurseries.

14740. Savina, R. A. 1968. THE DIET OF SILVER CARP IN THE PONDS OF THE RUSSIAN REPUBLIC. In Nikol'skii, G. V., ed.: Novye Issled. Ekol. Razved. rast.-yadn. Ryb (New investigations in the ecology and breeding of herbivorous fish), Nauka, Moskva, 116-23. (Bibl. 10; R; Vses. n-i Inst. prud. ryb. Khoz., Moskva Zh-33, Khlebnikov per 9, USSR); Weed Abstracts, 20(2): Abs. 745, 1970.

In trials in 1964-65, yearlings of Hypophthalmichthys molitrix preferred diatoms (Cyclotella sp. and young Melosira sp.) followed by Eugleniaceae and Protococcaceae. Consumption of blue-green algae (Oscillatoria sp. and Microcystis sp.) depended on their high concn in the water (20-36 mg/l.); when Oscillatoria sp. was the dominant phytoplankton in the Moscow region, fish digestive tracts contained up to 90% detritus and sand as well as Oscillatoria sp. indicating the reluctance of fish to consume the alga. The main diet of 2-year-old fish in the Krasnodar area was Eugleniaceae and diatoms. The diet of 3-year-old fish in the Ryazan' region was composed of Coelastrum sp. and Dictyosphaerium sp. and blue-green algae (Microcystis sp. and Coelosphaerium sp.). Microcystis sp. was readily eaten and the concn in the digestive tract was greater than that in the ponds; the larger fish seemed to prefer algae with relatively large cells. In a pond dominated by blue-green algae in the Krasnodar area, 4-year-old fish had well-filled digestive tracts whereas yearlings in the same pond swallowed large amounts of detritus and sand.

14741. Zubareva, E. L. 1968. EXPERIMENT IN THE INTRODUCTION OF HERBIVOROUS FISH TO COOLING RESERVOIRS IN THE URALS. In Nikol'skii, G. V., ed.: Novye Issled. Ekol. Razved. rast.-yadn. Ryb (New investigations in the ecology and breeding of herbivorous fish), Nauka, Moskva, 225-7. (R; Ural. Otdel. sev. n-i Inst. Gidrotekh. Melior., USSR); Weed Abstracts, 20(2): Abs. 746, 1970.

Fry of Ctenopharyngodon idella and Hypophthalmichthys molitrix were introduced into reservoirs of the Central Urals Thermal Power Station in summer 1964 in order to utilize and control aquatic vegetation. At natural water temperatures, the maximum weight at winter time reached 64 g for C. idella and 33 g for H. molitrix; survival over winter under ice was 85%. By autumn 1965, 2-year-old C. idella averaged 550 g. Fry of C. idella, reared at 24-28°C in a flow of warm water, reached an average of 180 g by the winter.

14742. Nikol'skii, G. V., and B. V. Verigin. 1968. RESULTS OF RESEARCHES WITH HERBIVOROUS FISH, BASIC OBJECTIVES AND DIRECTIONS OF FUTURE INVESTIGATIONS. In Nikol'skii, G. V., ed.: Novye Issled. Ekol. Razved. rast.-yadn. Ryb (New Investigations in the ecology and breeding of herbivorous fish), Nauka, Moskva, 12-19. (R; Mosk. gos. Univ., Moskva, USSR); Weed Abstracts, 20(2): Abs. 741, 1970.

Herbivorous fish have raised the fish production of ponds by 50-100% and more and have also proved to be excellent weed control agents in fish farming, irrigation and industrial reservoirs. Unexpected bonuses which have resulted include the reduction of mosquitoes by the elimination of larvae-harbouring plants and the reduction in weed fishes by the destruction of sheltering vegetation. Grass carp (Ctenopharyngodon idella) converts the mass of green pond vegetation into fertilizers thus increasing the pond's supply of natural nutrients. Grass carp can also be used to control weeds in rice paddies.

14743. Kharitonova, N. N., and Tarasova, O. M. 1968. COMBINED REARING OF COMMON AND GRASS CARPS IN THE UKRAINE. In Nikol'skii, G. V., ed.: Novye Issled. Ekol. Razved. rast-yadn. Ryb (New investigations in the ecology and breeding of herbivorous fish), Nauka, Moskva, 89-93. (Bibl. 3; Ukr. n-i Inst. ryb. Khoz., Kiev, ul. Artema 45a, USSR); Weed Abstracts, 20(2): Abs. 742.

Trials were carried out with the rearing of Cyprinus carpio and Ctenopharyngodon idella together in ponds at the Don Fishery Combine in 1964-65. Optimum spring stocking rates in 1964 were determined as 2500 common carp/ha, each weighing 39 g, with 250 grass carp/ha, each weighing 14 g; yields in September were 1.2 t and 0.14 t/ha respectively.

14744. Sorokin, Yu. I., and D. A. Panov. 1968. EXPERIMENTAL DETERMINATION OF THE FOOD CONSUMPTION OF HATCHLINGS AND FRY OF SILVER CARP (Hypophthalmichthys molitrix) WITH THE AID OF ^{14}C. Dokl. Akad. Nauk SSSR, 182(1): 208-10. (Bibl. 5; R; Inst. Biol. vnutren. Vod Akad. Nauk. SSSR, USSR); Weed Abstracts, 20(4): Abs. 1683.

14745. Bhatia, H. L. 1970. GRASS CARPS CAN CONTROL AQUATIC WEEDS. Indian Fmg, 20(2): 36-7; Weed Abstracts, 20(4): Abs. 1684.

Five grass carps (Ctenopharyngodon idella) averaging 1-1.25 kg in weight were introduced to each of three 1500-ft^2 ponds and fed daily with quantities of individual weed species; unconsumed weeds were netted out every 24 h and weighed Grass carps daily consumed $\geq$ 100-150% of their body weight of Najas minor (174%), Hydrilla verticillata, Ceratophyllum demersum, Vallisneria spiralis, Podostemon ceratophyllum and Potamogeton crispus and consumed 60-77% of their body weight of Lemna minor, and 18-40% of their body weight of Myriophyllum spathulatum and Eichhornia crassipes. A mixture of 45 kg of 7 weed species was fed to five 6.5-kg fish and the mixture was netted out daily and the weight of individual weeds determined. The order of preference shown by the fish was N. minor > H. verticillata > C. demersum > L. minor > M. spathulatum > V. spiralis > E. crassipes; E. crassipes was consumed only as a last resort. The 5 fishes took a total time of 144 h to consume all the 45 kg of weeds.

14746. Cross, D. G. 1970. THE TOLERANCE OF GRASS CARP Ctenopharyngod idella (Val.) TO SEAWATER. J. Fish Biol., No. 2, pp. 231-3. (Bibl. 6; Salmon & Freshwater Fisheries Lab., Min. Agric. Fish. Fd, Whitehall Place, London, S.W.1, England); Weed Abstracts, 20(4): Abs. 1685.

The possibility that grass carp introduced into English waterways for aquatic weed control might migrate through estuaries into other river systems prompted experiments to determine the tolerance of older grass carp to dilutions of an oceanic water. In aquaria maintained at 20.1°C±0.4°C the maximum time of survival in 30% sea-water (10.5 g NaCl/l.) and 50% sea-water (17.5 g NaCl/l.) was 24 days and 5 h respectively. The results indicate that migration of this species from one river system to another is impossible by way of the sea but is feasible between adjacent river systems separated by brackish water.

14747. Barlow, George W. 1972. THE ATTITUDE OF FISH EYE-LINES IN RELATION TO BODY SHAPE AND TO STRIPES AND BARS. Copeia, No. 1, pp. 4-12.

The function of obliterative eye-lines has gained general acceptance, but no one has attempted to account for the variability shown in the inclination of the line. There is a clear relationship between the steepness of the line and (a) the body shape of the species, and also with (b) the angle of the forehead. Vertical eye-lines are associated with deep bodies and steep foreheads, while horizontal lines are characteristic of the more elongate species with low foreheads; exceptions prove of considerable interest. An understanding of the adaptive significance of the attitude of the eye-line is aided by a consideration of the behavior and habitat of the fish in relation to the general color pattern. Longitudinal stripes occur on slender species that swim fast, whereas vertical bars typify deep-bodied fishes that turn sharply. The more closely a striped slender species is associated with the bottom, the more stripes it is apt to have. Barred species usually have deep bodies and live close to the substrate. Stripes or bars simultaneously serve as social signals and as antipredator markings. (Auth.)

14748. Alpaugh, Walter C. (5 Central St., Lebanon, New Jersey). 1972. HIGH LETHAL TEMPERATURES OF GOLDEN SHINERS (Notemigonus crysoleucas). Copeia, No. 1, p. 185.

This study indicates the high lethal temperature for N. crysoleucas to be near 40.0° C for fish acclimated at 22.0° C for 56 days.

14749. Johnson, Donald W., and W. L. Minckley. 1972. VARIABILITY IN ARIZONA BUFFALOFISHES. Copeia No. 1, pp. 12-17.

Introgressive hybridization, genetic drift, and character displacement are possible explanations for gill raker intermediacy in a population of buffalofish (Ictiobus) at Roosevelt Lake, Arizona. Gill raker counts and proportional body measurements of this population are compared to three species of buffalofishes (Ictiobus cyprinellus, I. bubalus, and I. niger) in Apache Lake, an adjacent Salt River reservoir, and a series from within the native range of the genus. Buffalofish from Roosevelt Lake have a greater body depth, longer head, a smaller less terminal mouth with more papillose lips, and a more massive gill arch with fewer rakers than I. cyprinellus of Apache Lake. (Authors)

14750. Hubbs, Clark, and Jimmy Pigg (Dept. of Zool., Univ. of Texas at Austin, Austin, Texas). 1972. HABITAT PREFERENCES OF THE HARLEQUIN DARTER, Etheostoma histrio, IN TEXAS AND OKLAHOMA. Copeia No. 1, pp. 193-194.

Specimens of Etheostoma histrio Jordan and Gilbert have been obtained by the senior author from several localities in eastern Texas during the last two decades. Every locality had sandy bottom and each harlequin darter was obtained in seine hauls set below log piles containing much detritus. It is concluded that when choice is available harlequin darters avoid gravel environments.

14751. Varga, Louis P., and C. Paul Falls (Dept. of Chem., Okla. State Univ., Stillwater, Oklahoma). 1972. CONTINUOUS SYSTEM MODELS OF OXYGEN DEPLETION IN A EUTROPHIC RESERVOIR. Environmental Science & Technology, 6(2): 135-142.

Several classes of mathematical simulation models have been tested in studies to relate the experimental dissolved oxygen (DO) concentrations to the parameters of eutrophication in Keystone Reservoir in north-central Oklahoma. One class of simulation model combined the features of mass transport by diffusion or turbulent transport, D, the measured flow rates in the impoundment, μ, and chemical reaction rates, r, in a series of special solutions to the equation

$$C = D\nabla^2 C - \mu\nabla C \pm r$$

where C is the DO concentration and ∇ is the gradient. Based on the experimental DO levels in the reservoir, the transfer coefficients or overall reaction rate constants were determined for the reaction between dissolved organic matter and dissolved oxygen for both first- and second-order kinetics under both steady-state and time-dependent conditions, and in two space coordinates. These models compared favorably with deterministic compartment models with first-order kinetics in their ability to predict the assimilative capacity of a reservoir. (Authors)

14752. Kochsiek, Kenneth A., Jerry L. Wilhm, and Robert Morrison (Dept. of Biol., Wis. State Univ., Superior, Wisconsin). 1971. SPECIES DIVERSITY OF NET ZOOPLANKTON AND PHYSIOCHEMICAL CONDITIONS IN KEYSTONE RESERVOIR, OKLAHOMA. Ecology, 52(6): 1119-1125.

Net zooplankton collections and physicochemical measurements were made monthly in four stations each in the Cimarron River and Arkansas River arms and one station at the dam of Keystone Reservoir, Oklahoma, from June 21, 1967 to June 24, 1968. Conductivity was considerably greater in the Cimarron Arm than in the Arkansas Arm or at the dam, while turbidity, alkalinity, and zooplankton density were generally higher in the Arkansas arm. Variation among stations in temperature and dissolved oxygen was slight. A total of 44 taxa of zooplankton were collected. Shannon's formula was used to evaluate species diversity ($\bar{d}$) of zooplankton. Variance values of $\bar{d}$ indicated only a slight gain in precision by increasing the sample size to above 400 individuals. Mean annual species diversity was slightly lower in the Cimarron Arm than in the Arkansas Arm. Diversity values decreased slightly through early winter and decreased abruptly and reached minimum values in late winter and early spring. Coefficients of correlation between physicochemical parameters and species diversity unadjusted for month and station effect were compared with adjusted coefficients. (Authors)

14753. Johnson, M. G., and R. O. Brinkhurst (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1971. ASSOCIATIONS AND SPECIES DIVERSITY IN BENTHIC MACROINVERTEBRATES OF BAY OF QUINTE AND LAKE ONTARIO. J. Fish. Res. Bd. Canada, 28(11): 1683-1697.

Three main macroinvertebrate associations were found in the Bay of Quinte, Prince Edward Bay, and the adjacent area of Lake Ontario: a chironomid association of the eutrophic inner and middle bays; an association of many species of sphaeriids, oligochaetes, chironomids, and crustaceans in the mesotrophic lower Bay of Quinte and Prince Edward Bay; and a cold-stenotherm association of the oligotrophic deep basin of Lake Ontario. An additional, but more confined (inner Prince Edward Bay), association consisted of a variety of taxa, whose distribution appeared to be related to the distribution of vascular vegetation. All of the main taxonomic groups contributed to each association and to differences among associations. The lakeward progression of associations in the study area was closely similar to the west to east shifts in Lake Erie reported earlier. Species diversity in Lake Ontario associations apparently was related to degree of eutrophy and to water temperature. (Authors)

14754. Johnson, M. G., and R. O. Brinkhurst (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1971. PRODUCTION OF BENTHIC MACROINVERTEBRATES OF BAY OF QUINTE AND LAKE ONTARIO. J. Fish. Res. Bd. Canada, 28(11): 1699-1714.

Production rates (P) by benthic macroinvertebrates, obtained from data on instantaneous growth rate and biomass (B), ranged from 0.26 kcal m^{-2} day^{-1} at the inner bay station to 0.80 in the outer bay, 0.19 at the bay mouth, 0.16 outside the Bay of Quinte, and 0.04 in the main basin of Lake Ontario. Respiration rates (R) of the common species were fitted to the general model $\log_e R = a_1 T + a_2 \log_e W$, where T is temperature and W is animal weight. Q_{10}'s averaged 3.5 and exponents of animal weight averaged 0.74. Growth efficiencies (production as a proportion of assimilation) declined progressively from about 0.65 at the inner bay station to 0.35 at the Lake Ontario station. Annual turnover ratios (P:B ratios) declined from 13 in the inner bay to about 1 in the deep sediments of Lake Ontario. Turnover ratio (TR) was correlated with mean annual bottom temperature (T), $TR = \frac{T^2}{10}$, and production was predicted by $P = B \frac{T^2}{10}$. (Authors)

14755. Johnson, M. G., and R. O. Brinkhurst (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1971. BENTHIC COMMUNITY METABOLISM IN BAY OF QUINTE AND LAKE ONTARIO. J. Fish. Res. Bd. Canada, 28(11): 1715-1725.

Rates of sedimentation of organic matter to the bottom sediments at four stations (in order from the inner Bay of Quinte to open Lake Ontario) averaged 1.91, 0.42, 0.36, and 0.21 g m^{-2} day^{-1}. Respective respiration rates of sediment cores averaged 0.35, 0.25, 0.22, and 0.15 g O_2 m^{-2} day^{-1}. Approximately 90% of imported energy (IM) was used by the benthic communities at the three lakeward stations and 23% at the inner bay station. Low utilization in the inner bay was substantiated by the high organic matter (28%) in sediments there, in contrast with Lake Ontario sediments (3-4%). Low utilization was attributed to the relatively greater proportion of allochthonous import. Only 2% of imported energy was assimilated by macroinvertebrates in the inner bay, in contrast with about 30% at the lakeward stations. A concise model of macroinvertebrate production, $P = c(a \cdot b\ IM)$ (where c is the proportion of growth to respired and exported energy and is derived from the average growth efficiency of macroinvertebrates, a is proportion of imported energy used by the total benthic community, and b is proportion of the latter used by macroinvertebrates), was used to deduce the relation between production and import. All of the parameters a, b, and c presumably decrease with increasing import, although c may be low initially at low import and sparse food supply. (Authors)

14756. Echelle, Anthony, and Carl D. Riggs (Univ. of Okla., Biol. Sta., Willis, Oklahoma). 1972. ASPECTS OF THE EARLY LIFE HISTORY OF GARS (Lepisosteus) IN LAKE TEXOMA. Trans. Amer. Fish. Soc., 101(1): 106-112.

14757. Tyler, A. V. (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. SURGES OF WINTER FLOUNDER, Pseudopleuronectes americanus, INTO THE INTERTIDAL ZONE. J. Fish. Res. Bd. Canada, 28(11): 1727-1732.

Movement of winter flounders, Pseudopleuronectes americanus (Walbaum), into the intertidal zone was observed by underwater television situated in a herding fence. Flounders enter the intertidal zone with the rising tide. Peak movement occurs 2-2.5 hr after low tide. Movement generally falls off 3.5 hr after tide begins to rise. Flounders occupy the area for 6-8 hr and then surge back to the sublittoral 2.5-0.5 hr before the next low tide. Small flounders move with the same synchrony as large flounders but tend to make short movements up and down the beach, with net movement away from shore while tide is falling. Large flounders are more strictly directional. Movements of eight species that occurred with the flounder are compared. Because of the scale of the flounder movement, and because of published observations of pleuronectids feeding in the intertidal zone, it is proposed that the intertidal zone is a major feeding area for northern populations of winter flounder. Actions that interfere with productivity in the intertidal zone (oil pollution, tidal impoundments) are likely to reduce productivity of flounder populations. (Auth.)

14758. Fujihara, M. P., P. A. Olson, and R. E. Nakatani (Dept. of Biol., Pacific Northwest Labs, Battelle Mem. Inst., Richland, Washington). 1971. SOME FACTORS IN SUSCEPTIBILITY OF JUVENILE RAINBOW TROUT AND CHINOOK SALMON TO Chondrococcus columnaris. J. Fish. Res. Bd. Canada, 28(11): 1739-1743.

Susceptibility of juveniles of chinook salmon (Oncorhynchus tshawytscha) and rainbow trout (Salmo gairdneri) to Chondrococcus columnaris disease appeared to be influenced by age of fish, crowding, and water temperature. Rainbow trout of about 1 g and chinook salmon of about 3 g were less susceptible than smaller fish, and tests with chinook salmon suggested that age was more important than weight. When chinook salmon averaging 4.3 g were exposed from July to October to the pathogen in river water, mortality ranged from 1.0% in a trough with 50 fish to 12% in one with 900. Mortality of rainbow trout averaging 2.4 g that were exposed to the pathogen in trough river water averaged 4.7-22% after 4 weeks, at temperatures from 17.2 to 17.8 C; the survivors, however, were generally resistant to subsequent infection, suggesting development of an immune response. Times to 100% mortality of sibling chinook salmon averaging 3.9 g that were exposed for 25 min to about 2.5×10^5 organisms per liter of sterile river water were about 19 hr at 10 C and 8 hr at 22 C. Survival of rainbow trout was higher when they were held at 2.2 degrees C below than when held at 2.2 degrees C above seasonal river temperatures. (Authors)

14759. Beamish, R. J., and H. Tsuyuki (Dept. of Zool, Univ. of Toronto, Toronto, Canada). 1971. A BIOCHEMICAL AND CYTOLOGICAL STUDY OF THE LONGNOSE SUCKER (Catostomus catostomus) AND LARGE AND DWARF FORMS OF THE WHITE SUCKER (Catostomus commersoni). J. Fish. Res. Bd. Canada, 28(11): 1745-1748.

White (Catostomus commersoni) and longnose (C. catostomus) suckers possess diploid complements of 98 chromosomes, including metacentrics, submetacentrics, and acrocentrics. White sucker karyotypes differ consistently from longnose karyotypes by the presence of an additional four metacentrics. The karyotypes of the size and age at maturity of variants of white suckers were indistinguishable. Biochemically, longnose and white suckers are distinctive with respect to muscle myogens, hemoglobins, serum esterases, serum and muscle lactate dehydrogenases, and serum transferrins. The last group of proteins provides a clear genetic separation of the large-sized, late-maturing, and the dwarf, early-maturing white suckers. The former is polymorphic for serum transferrins. (Authors)

14760. Bilton, H. T., and G. L. Robins (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. EFFECTS OF STARVATION, FEEDING, AND LIGHT PERIOD ON CIRCULUS FORMATION ON SCALES OF YOUNG SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 28(11): 1749-1755.

Young sockeye salmon (Oncorhynchus nerka) survived a starvation period of 20 weeks with no change in their mean length and weight and with no record of this starvation period on their scales. Fish offered an ad libitum diet for more than 4 weeks in the 20-week period had significant increases in body and scale growth. The number of checks on their scales was correlated with the number of weeks fish were offered an ad libitum diet and not with the number of weeks they were starved. Thus, a significant increase in food induced the formation of a check. Light period appeared to have some influence on body and scale growth. (Authors)

14761. Bilton, H. T., and G. L. Robins (Fish. Res. Bd. Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. RESPONSE OF YOUNG SOCKEYE SALMON (Oncorhynchus nerka) TO PROLONGED PERIODS OF STARVATION. J. Fish. Res. Bd. Canada, 28(11): 1757-1761.

Young sockeye were held without food for periods of 20 and 30.5 weeks with few mortalities. As was reported in previous experiments, no record of the periods of starvation appeared on the scale, nor did checks form under these conditions. Those fish offered food after 20 weeks of starvation responded immediately and showed significant increases in body and scale growth at the end of 10 weeks feeding. Fish offered food after 30.5 weeks of starvation also responded immediately, but when the experiment ended after 5 weeks of feeding no significant increases in body and scale growth were apparent, indicating insufficient recovery time. A significant increase in the incidence of checks was associated with subsequent feeding. Light period did have some influence on body and scale growth. (Authors)

14762. Schindler, D. W., F. A. J. Armstrong, S. K. Holmgren, and G. J. Brunskill (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1971. EUTROPHICATION OF LAKE 227, EXPERIMENTAL LAKES AREA, NORTHWESTERN ONTARIO, BY ADDITION OF PHOSPHATE AND NITRATE. J. Fish. Res. Bd. Canada, 28(11): 1763-1782.

Addition of 0.34 g P as Na_2HPO_4 and 5.04 g N as $NaNO_3$ per square meter to a small unproductive Canadian Shield lake over a period of 17 weeks caused a severalfold increase in phytoplankton standing crop, and a change in dominant species from Chrysophyceae to Chlorophyta. Reactive phosphate concentrations remained at undetectable levels in the epilimnion after fertilization, and inorganic nitrogen concentrations remained low. Most of the added phosphorus and nitrogen was rapidly taken up by phytoplankton and sedimented with the seston. Although concentrations of total CO_2 decreased to less than 20 μmoles/liter and pH values increased to greater than 9 in late summer, a high standing crop of phytoplankton was maintained. No marked increase in the rate of phytoplankton production was noticed. CO_2 indicated that carbon was not limiting to algal production, except possibly at algal standing crops in excess of 100 μg/liter chlorophyll a, and that phosphorus was the primary limiting nutrient. Sodium added with the nutrients remained in the epilimnion until fall overturn, indicating that very little of it was utilized by phytoplankton. (Authors)

14763. Symons, Philip E. K. (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. ESTIMATING DISTANCES BETWEEN FISH SCHOOLING IN AN AQUARIUM. J. Fish. Res. Bd. Canada, 28(11): 1805-1806.

Distances between fish schooling in an aquarium can be estimated easily from simultaneous photographs, one taken from overhead and the other from the side. No special equipment is required, and the method is accurate to within 2 or 3 mm. (Auth.)

14764. Cross, Ford A., James N. Willis, and John P. Baptist (NMFS, Atlantic Coastal Fisheries Center, Beaufort, North Carolina). 1971. DISTRIBUTION OF RADIOACTIVE AND STABLE ZINC IN AN EXPERIMENTAL MARINE ECOSYSTEM. J. Fish. Res. Bd. Canada, 28(11): 1783-1788.

The distribution of radioactive and stable Zn in an experimental marine ecosystem is described. We added 1 mCi of ^{65}Zn to 2000 liters of sea water and a mixed community of planktonic and benthic algae in a fiberglass tank, after which the ecosystem was left undisturbed for 9 months. We then measured the ^{65}Zn specific activities for (1) particulate Zn (0.45 μ filterable), (2) extractable Zn (from water passed through a 0.45-μ filter and then treated with dithizone), (3) total dissolved Zn (from samples passed through a 0.45-μ filter and treated with acid prior to extraction with dithizone), and (4) dialyzable Zn. Zinc-65 specific activities were not significantly different among the extractable, dialyzable, or acid-treated samples of the water. Further, absolute concentrations of ^{65}Zn and total Zn were no higher in the acid-treated samples than in the extracted or dialyzed samples, which indicates that nearly all of the soluble Zn in the water was dithizone-extractable and dialyzable. Zinc-65 specific activities were significantly less, however, in the particulate material than in the water. This difference indicates that equilibrium of Zn between particulate material and water had not been reached after 9 months. Three months later (December 1969) ^{65}Zn specific activities were determined again for particulate material and total dissolved Zn. The mean specific activity of ^{65}Zn in the particulate samples showed a small but significant increase, but it was still less than in the water. Concentration factors in the particulate matter were 980 for ^{65}Zn and 1400 for total Zn. Samples of benthic algae taken in March 1970 had a mean specific activity of ^{65}Zn similar to the mean ^{65}Zn specific activity of water samples taken 3 months earlier. (Authors)

14765. McCauley, R. W., and W. L. Pond (Dept. of Biol., Waterloo Lutheran Univ., Waterloo, Ontario, Canada). 1971. TEMPERATURE SELECTION OF RAINBOW TROUT (Salmo gairdneri) FINGERLINGS IN VERTICAL AND HORIZONTAL GRADIENTS. J. Fish. Res. Bd. Canada, 28(11): 1801-1804.

Preferred temperatures of underyearling rainbow trout (Salmo gairdneri) were determined in both vertical and horizontal temperature gradients. No statistically significant difference was found between the preferred temperatures by the two different methods. This suggests that the nature of the gradient plays a lesser role than generally believed in laboratory investigations of temperature preference. (Authors)

14766. Gillespie, D. C., and D. P. Scott (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1971. MOBILIZATION OF MERCURIC SULFIDE FROM SEDIMENT INTO FISH UNDER AEROBIC CONDITIONS. J. Fish. Res. Bd. Canada, 28(11): 1807-1808.

A system for studying the aerobic mobilization of mercury from aquatic sediments into fish was described. Using this method, it was shown that mercuric sulfide in sediment was very slowly mobilized and picked up by fish. (Authors)

14767. McCosker, John E., and Ross F. Nigrelli (Scripps Inst. of Oceanogr., Univ. of Calif., San Diego, La Jolla, California). 1971. NEW RECORDS OF LYMPHOCYSTIS DISEASE IN FOUR EASTERN PACIFIC FISH SPECIES. J. Fish. Res. Bd. Canada, 28(11): 1809-1810.

Four new records of lymphocystis viral disease are described for gobiid and diodontid fishes. Spontaneous infection was found in Diodon holocanthus and Gobiosoma paradoxum from the Gulf of Panama and in Gillichthys seta from the upper Gulf of California. Infection was intragenerically transferred to Diodon hystrix in a cohabitation experiment. (Authors)

14768. Kionka, B. C., and J. T. Windell (Fish Physiol. Lab., Univ. of Colo., Boulder, Colorado). 1972. DIFFERENTIAL MOVEMENT OF DIGESTIBLE AND INDIGESTIBLE FOOD FRACTIONS IN RAINBOW TROUT, Salmo gairdneri. Trans. Amer. Fish. Soc., 101(1): 112.

14769. McCarraher, D. B. (Nebr. Game and Parks Comm., Office of Limnol., Hastings Coll., Hastings, Nebraska). 1971. SURVIVAL OF SOME FRESHWATER FISHES IN THE ALKALINE EUTROPHIC WATERS OF NEBRASKA. J. Fish. Res. Bd. Canada, 28(11): 1811-1814.

Of 14 species of freshwater fishes held in cages in one or more of 13 alkaline lakes and ponds in Nebraska, few species survived more than a month where carbonate alkalinity, mostly as compounds of Na_2CO_3 and KCO_3, was above 300 mg/liter. Of the 14 species tested, Sacramento perch (Archoplites interruptus), fathead minnow (Pimephales promelas), northern pike (Esox lucius), and the black bullhead (Ictalurus melas), were the most tolerant of alkaline environments. Most centrarchid fishes except A. interruptus and the green sunfish (Lepomis cyanellus), did not survive more than a month in alkaline waters greater than 950 mg/liter total alkalinity. A lake classification index for slightly alkaline to strongly alkaline environments is presented, along with suggested fish species for introduction into such waters. (Auth.)

14770. Duedall, I. W. (Fish. Res. Bd. of Canada, Marine Ecology Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1971. A DISPENSER FOR WINKLER'S DISSOLVED OXYGEN REAGENTS. J. Fish. Res. Bd. Canada, 28(11): 1815-1816.

A new dispenser for delivering Winkler's oxygen reagents simultaneously is described. (Auth.)

14771. Crowley, G. J., and D. J. Berinati (Bur. of Sport Fish. and Wildl., Sierra Nevada Aq. Res. Lab., Bishop, California). 1972. EFFECT OF MS-222 ON BLOOD SUGAR AND LIVER GLYCOGEN IN RAINBOW TROUT. Trans. Amer. Fish. Soc., 101(1): 125-128.

For quick anesthetization followed by immediate sampling, MS-222 does not affect carbohydrate metabolism significantly. However, anesthetization with low concentrations of MS-222 for longer terms can result in significant alterations in carbohydrate metabolism.

14772. Bates, Daniel W., Ernest W. Murphey, and Martin G. Beam (NMFS Biol. Lab., 2725 Montlake Blvd. East, Seattle, Washington). 1971. TRAVELING SCREEN FOR REMOVAL OF DEBRIS FROM RIVERS. U. S. Dept. of Comm., NOAA Technical Report NMFS SSRF-645, 6 p., illus.

This report describes the features and operation of a traveling debris screen, installed within a 12.2-m wide test flume in the Grande Ronde River near Troy, Oreg. The National Marine Fisheries Service developed the screen to improve removal of debris from canals and rivers of the Pacific Northwest and to reduce costs of removal. Trash racks are now used to remove debris, but they have been considered impractical because of maintenance difficulties during floods and because of their large size. (Authors)

14773. Cairns, John, Jr., and Guy R. Lanza (Dept. of Biol., Va. Polytechnic Inst., and State Univ., Blacksburg, Virginia). 1972. THE EFFECTS OF HEATED WASTE WATERS ON SOME MICROORGANISMS. VPI-WRRC Bull. No. 48, 99 p.

The effects of thermal stress on selected aquatic microorganisms were investigated in these experiments. Numerous categories of temperature shock were studied with emphasis on (1) general simulation of the passage of water through a condensing system of a steam electric power plant to determine the effects of this exposure and (2) the effects of such entrainment upon the microbial system below the discharge point. Three general groups of organisms were examined: protozoans, algae, and chytridiaceous fungi. New equipment developed specifically to aid in these studies (a simple apparatus for delivering heat shock to microorganisms) and a new fluorescent survey technique to characterize stress induced cellular alterations are described in detail. (Authors)

14774. Giger, Richard D., and DeWayne A. Williams (Ore. State Game Comm., Div. of Wildl. Res., Ore. State Univ., Corvallis, Oregon). 1972. A NET-BOARD FOR SETTING BEACH SEINES FROM SMALL BOATS. Trans. Amer. Fish. Soc., 101(1): 133-135.

14775. Sabodash, V. M. 1971. LOCALIZATION OF ZINC IN CARP SPAWN, EMBRYOS, AND LARVAE. Hydrobiological Journal, published by Amer. Fish. Soc., 7(1): 36-41.

A histochemical technique was used to detect zinc in ovulated carp spawn and larvae during different stages of development. The zinc was found to concentrate in ovulated spawn and in the yolk granules of hatched larvae with a yolk sac. After resorption of the yolk sac, zinc was found in future bony tissues at the onset of their mineralization. Dithizone apparently reveals only ionic zinc or zinc loosely bound in organometallic compounds. (Auth.)

14776. Movchan, N. A., and O. S. Korotkevich. 1971. MICROORGANISMS GROWING ON Coregonus pelad SPAWN. Hydrobiological Journal, published by Amer. Fish. Soc., 7(1): 32-36.

A variety of microorganisms - bacteria, fungi, and algae - are found on the egg membranes of Coregonus pelad spawn. The authors identified 48 bacterial strains belonging to the genera Bacterium, Bacillus, and Micrococcus. They also found an unknown algal species similar to the blue-green alga Chamaesiphon curvatus (Borzi) Nordst and the little studied Cyanophanon mirabile Geitler. The development of fish embryos from infected spawn proceeds without any apparent abnormalities. (Authors)

14777. Mann, Hans (Bundesforschungsanstalt für Fischerei, Institut für Kusten- und Binnenfischerei Hamburg, Germany). 1971. BIOLOGICAL EFFECTS OF FATTY ALCOHOLS ON FRESHWATER ANIMALS (Biologische Auswirkungen von Fettalkoholen auf Subwassertiere). Int. Revue ges. Hydrobiol., 56(4): 599-607. In German with English summary.

During the last few years tests have been performed, especially by American authorities, to reduce the evaporation of natural or artificial water reservoirs by covering the water surface with fatty alcohols. The alcohols are spread over the water surface in a more or less closed monomolecular layer. With this procedure there is the possibility that fish or other water organism get into contact with this protective layer. Our tests which were performed with fatty alcohols by Condea, have shown after an observation period of eight days that Copepodes, Daphnia, and Tubificide do not take any damage. If species like Lebistes reticulatus or Salmo gairdneri are kept in a tank the surface of which is covered with fatty alcohols, and fed on live food or dried food, these foods are taken without any subsequent damages, although these foods, when given into the tank sink through the fatty alcohols layer and possibly absorb small quantities of them. If fatty alcohols are mixed into the dried food, the fish accept it nevertheless. Any signs of disease or poisoning have not been observed. By spreading fatty alcohols over the water the normal surface pressure of water against air of 75 dyn/cm (at 10° C) is reduced to about 40 dyn/cm. Due to this surface pressure decrease water insects moving on the water surface like for example Gerris, cannot keep themselves on the surface but sink and drown. Equally all insects or insect larvae which come to the water surface for breathing or hatching, are unable to keep themselves at the "tension-relieved" water surface and sink back into the water. If they do not have the possibility to hold themselves on aquatic plants or floating objects, they suffocate within a short space of time. (Auth. summ.)

14778. Sanders, Marilyn M., and Gordon H. Dixon (Dept. of Biochem., Univ. of British Columbia, Vancouver 8, Canada). 1972. THE BIOSYNTHESIS OF PROTAMINE IN TROUT TESTIS. IV. SITES OF PHOSPHORYLATION. J. Biol. Chem., 247(3): 851-855.

After completion of the synthesis of protamine in the cytoplasm of rainbow trout testis spermatid cells, the seryl residues of the molecule are phosphorylated. Amino acid sequence studies of three components of rainbow trout protamine each containing 4 seryl residues show that 3 seryl residues occur together in the NH_2-terminal half of each protamine in the sequence Arg-Ser-Ser-Ser-Arg and the 4th in the COOH-terminal half of the molecule in the sequence Val-Ser-Arg. It is shown here that tryptic phosphopeptides in which each seryl residue is recovered

in the phosphorylated form can be isolated from a protamine labeled with [^{32}P] phosphate in vivo. In addition, a further series of phosphoseryl peptides corresponding to the sequence Arg-Ser(PO_4)-Ser(PO_4)-Arg have been isolated, and it is suggested that these are derived from an as yet unsequenced component of rainbow trout protamine. An ionophoretic method for determining whether a given seryl residue is phosphorylated is also described. (Authors summ.)

14779. Kerstetter, Theodore H., and Leonard B. Kirschner (Dept. of Zool., Wash. State Univ., Pullman, Washington). 1972. ACTIVE CHLORIDE TRANSPORT BY THE GILLS OF RAINBOW TROUT (Salmo gairdneri). J. Exp. Biol., 56(1): 263-272.

The kinetics of chloride transport by the irrigated trout gill have been studied. The transport system is saturable, and the half-saturation value is about 0.25 mM. Chloride uptake occurs equally well from solutions of non-penetrating cations and from NaCl solutions. The presence of potassium in the irrigating solution, however, significantly inhibits chloride uptake. The trout gill is permeable to potassium, and there appears to be an active component to potassium influx. Chloride transport is stimulated by injections of $NaHCO_3$ and $(NH_4)HCO_3$. The carbonic anhydrase inhibitor, acetazolamide, has no apparent effect on chloride influx, and it is suggested that if a Cl^-/HCO_3^- exchange exists in the trout gill, sufficient HCO_3^- can be supplied by the blood. The mean intracellular potential (relative to the irrigating solution) of five gill filament cells was -32 mV. This indicates the presence of an energy barrier to chloride uptake at the outer membrane of the epithelium, and therefore it is postulated that an active step for chloride transport is located on this membrane. (Authors summ.)

14780. Smith, C. E., L. R. McLain, and W. S. Zaugg (Western Fish Nutr. Lab., Bur. of Sport Fish. & Wildl., Cook, Washington). 1971. PHENYLHYDRAZINE-INDUCED ANEMIA IN CHINOOK SALMON. Toxicol. appl. Pharmacol., No. 20, pp. 73-81, illus.

Single injections of phenylhydrazine (12.5 μg/g body weight) produced severe hemolytic anemia in chinook salmon (Oncorhynchus tshawytscha). Within 10 days erythrocyte counts, hemoglobin concentrations, and hematocrits were reduced to 1-5% of normal. Microscopic examination revealed pronounced swelling and rupture of erythrocyte nuclei and degenerated erythrocytes in blood vessels of all organs studied. Histologic changes were noted in the kidney, liver and spleen. Blood components returned to near normal levels 95 days after injection. (Authors)

14781. Gibson, David I. (Zool. Dept., Univ. of Aberdeen, Scotland). 1972. FLOUNDER PARASITES AS BIOLOGICAL TAGS. J. Fish Biol., 4(1): 1-9.

The use of fish-parasites as biological tags may become an efficient method of tracing the origin of some migratory fish. The helminth parasites of flounders Platichthys flesus (L.) from 2 estuaries and from the sea within a 40 mile range were recorded, and an attempt was made to explain the level of infestation of each species of parasite in the 3 localities in relation to their life history and the physical nature of the environment. The flounders from the 3 localities were shown to have dissimilar parasite-faunas, and, therefore, it was possible to characterize the parasite-fauna for each of the 3 groups of flounders. Individual fish from each locality could be recognized by its parasite-fauna and especially by the level of certain indicator-parasites. Similarly, "foreign" flounders moving into a flounder population could be picked out by the markedly different composition of their parasite-fauna. Podocotyle sp. and Zoogonoides viviparus were useful indicator-parasites in this instance. (Auth.)

14782. Robison, Henry W., and Rudolph J. Miller (Dept. of Zool., Okla. State Univ., Stillwater, Oklahoma). 1972. A NEW INTERGENERIC CYPRINID HYBRID (Notropis pilsbryi X Chrosomus erythrogaster) FROM OKLAHOMA. Sthwest. Nat., 16(3 and 4): 442-444.

14783. Roberts, Ronald J., W. M. Shearer, and A. L. S. Munro (Dept. of Vet. Pathol., Univ. of Glasgow Vet. School, Scotland). 1972. STUDIES ON ULCERATIVE DERMAL NECROSIS OF SALMONIDS. IV. FAILURE TO DETECT EPITHELIAL AUTO-ANTIBODIES IN SERA FROM DISEASED FISH. J. Fish Biol., 4(1): 21-25.

Six salmon Salmo salar (L.) were vaccinated with an extract of normal salmon skin, to elicit production of anti-epithelial antibodies. These were produced within 8 weeks and were readily detectable by immunofluorescence, no evidence for the presence of similar antibodies in UDN infected salmon or normal salmon or trout was obtained. Experimental traumatization of the skin of vaccinated salmon with dry ice failed to produce pemphigus type lesions and it was concluded that UDN was not an auto-immune disease of the pemphigus type. (Authors)

14784. Young, A. H., P. Tytler, F. G. T. Holliday, and A. MacFarlane (Univ. of Stirling, Scotland). 1972. A SMALL SONIC TAG FOR MEASUREMENT OF LOCOMOTOR BEHAVIOUR IN FISH. J. Fish Biol., 4(1): 57-65.

A technique for measuring the patterns and levels of swimming activity of unrestrained fish in their natural environment during a period of 24 h is described. The fish were marked with small tags which emitted continuous ultrasonic signals by which they could be located and tracked using submerged, remotely controlled, directional hydrophones. Preliminary results obtained from 2 brown trout (Salmo trutta) showed a pronounced diurnal activity pattern and remarkably low swimming activity levels. (Authors)

14785. Fisher, Paul B., and Joseph W. Rachlin (Dept. of Biol. Sciences, Herbert W. Lehman Coll. of the City Univ. of N. Y., Bedford Park Blvd. West, Bronx, New York). 1972. KARYOTYPIC ANALYSIS OF 2 SYMPATRIC SPECIES OF FISH, Fundulus heteroclitus L. AND F. majalis. J. Fish Biol., 4(1): 67-71.

A chromosome study was performed on 2 sympatric species of marine fish, Fundulus heteroclitus L. and F. majalis. A modification of techniques which included the combination of the procedures of McPhail & Jones (1966) with those more recently developed by Ohnuki (1968), for demonstrating the spiral structure of cultured human leukocytes, resulted in clear and distinct chromosome spreads from gill epithelial cells of these 2 species. Optimum chromosome spreading and accumulation of metaphase figures resulted when specimens of F. heteroclitus received either a 0.28 ml or a 0.4 ml injection of a 0.1% colcemid solution for 45 h and 48 h respectively. Best results in F. majalis occurred when specimens received a 0.1 ml dose of the 0.1% colcemid solution for 22-1/2 h. Studies of the karyotypes of 18 specimens of F. heteroclitus and 9 specimens of F. majalis indicated that the 2N chromosome number for each species was 48. (Authors)

14786. Laurence, Geoffrey C. (Dept. of Conserv., Cornell Univ., Ithaca, New York). 1972. COMPARATIVE SWIMMING ABILITIES OF FED AND STARVED LARVAL LARGEMOUTH BASS (Micropterus salmoides). J. Fish Biol., 4(1): 73-78.

Sustained swimming abilities of fed and starved larval largemouth bass (Micropterus salmoides L.) were compared in the first week after swimming initiation. Fed larvae improved to a sustained velocity of 4.0 cm/sec while starved larvae attained a velocity of only 1.5 cm/sec. Swimming behaviour for fed and starved larvae was quantified for number of moves, average distance/move, and total-distance for all moves in 1 min intervals. Fed larvae were always more active than starved larvae, although real differences did not appear until the 4th day after swimming initiation. (Auth.)

14787. Cragg-Hine, D. (Fish. Res. Lab., Min. of Agric., The Cutts, Coleraine, Northern Ireland). 1972. FURTHER NOTE ON THE SALMONID POPULATIONS OF THE LOUGH ERNE TRIBUTARIES IN NORTHERN IRELAND. J. Fish Biol., 4(1): 17-20.

Confirmatory evidence has been obtained that pre-spawning losses from ulcerative dermal necrosis (UDN) may have affected recruitment of salmonid stocks in the Lough Erne spawning streams during 1967/68. (Auth.)

14788. Houston, Arthur H., and Mary Anne DeWilde (Dept. of Biol., Marquette Univ., Milwaukee, Wisconsin). 1972. SOME OBSERVATIONS UPON THE RELATIONSHIP OF MICROHAEMATOCRIT VALUES TO HAEMOGLOBIN CONCENTRATIONS AND ERYTHROCYTE NUMBERS IN THE CARP Cyprinus carpio L. AND BROOK TROUT Salvelinus fontinalis (Mitchill). J. Fish Biol., 4(1): 109-115.

Simultaneous determinations of microhaematocrit, erythrocyte numbers and haemoglobin concentrations have been obtained for samples of carp and trout of both sexes acclimated to various temperature regimes, and varying seasonal and nutritional states. Because haematological parameters have been used as indices of physiological condition in fishes correlational and multivariant regression analyses were carried out in an effort to determine whether valid correlations existed between the readily-determined parameter, microhaematocrit, and the other 2 variables. Results obtained indicate that microhaematocrit can be used as a general index of haematological status in the carp but not the brook trout. (Authors)

14789. de Vlaming, Victor L. (Dept. of Zool., Univ. of Calif., Berkeley, California). 1972. ENVIRONMENTAL CONTROL OF TELEOST REPRODUCTIVE CYCLES: A BRIEF REVIEW. J. Fish Biol., 4(1): 131-140.

Reports concerned with the environmental regulation of teleost reproductive cycles are critically reviewed. Photoperiod and temperature have been the most frequently studied environmental factors with respect to control of sexual cycling. Photoperiod may exert the dominant regulatory role in the salmonid family, but few species have been examined so no conclusive statement is presently possible. Both photoperiod and temperature may be important controlling factors in the cyprinid family, but inadequate controls prohibit meaningful interpretation. Temperature may be extremely important in regulating reproductive cycles in the cyprinodontiform fishes. Although the data are inconclusive, it appears that changes in daylength play some role in reproductive cycling in the gasterosteids. Photoperiod and temperature seem to interact in regulating the sexual cycles in the 2 periform species investigated. It is concluded that short term laboratory studies may lead to erroneous statements concerning the importance of exogenous factors in controlling annual reproductive cycles. Although photoperiod has been credited as the dominant environmental regulatory factor in many previous investigations, photoperiodism seems to be temperature sensitive in a majority of the teleost species studied. Responsiveness to exogenous factors appears to depend on the gonadal condition of the beginning controls (effects vary with season). Considerable variation is seen in the reproductive timing mechanisms among the teleosts and few generalizations can be made with regard to phylogenetic, geographic or ecological relationships of the fishes studied. (Auth.)

14790. Meade, T. G., and C. A. Bedinger, Jr. (Dept. of Biol., Sam Houston State Univ., Huntsville, Texas). 1972. HELMINTH PARASITISM IN SOME SPECIES OF FRESH WATER FISHES OF EASTERN TEXAS. Sthwest. Nat., 16(3 and 4): 281-295.

For five years an intensive study was made of the helminth parasites in fresh water fishes of Madison and Walker counties, eastern Texas. Four hundred and fifty-four fish respresenting 32 species and 10 families were critically examined for their parasites. Species recovered included 38 monogenetic and 12 digenetic trematodes, two cestodes, six nematodes and two acanthocephala. Two fish-infecting cercarial types and two metacercariae were also studied. The parasites and their fish hosts are summarized herein with new host records indicated. (Authors)

14791. Hill, Loren G. (Univ. of Okla. Biol. Sta. and Dept. of Zool., Univ. of Okla., Norman, Oklahoma). 1972. SOCIAL ASPECTS OF AERIAL RESPIRATION OF YOUNG GARS (Lepisosteus). J. Fish Biol., 4(1): 239-247.

The degree of social facilitation involved in the aerial-breathing behavior of young gars was studied. Data indicated that, within a group of two conspecifically grouped gar, 74.4% of the time a rise in one would induce a rise in the other. Conversely, within a group of four longnose gar, only 15.6% of the time did an initial

rise not induce rises in one or more companions. The mean time for an imitative rise by a gar, following the previous rise, whether imitative or non-imitative, was sufficiently close to the mean time for a non-imitative rise to indicate the importance of a physiological respiratory threshold being reached before a rise in one gar would induce an imitative one in another. Within a group of three heterospecifically grouped gar, only 6.9% of the time did an initial rise induce rises in its heterospecific companions. In all experiments, the percentage of induced rises decreased as the number of gar rising at one time increased. Success was obtained in inducing rises with a gar model manipulated so as to simulate the normal rise of these fish. (Auth.)

14792. Czeczuga, B. (Dept. of Biol., Bialystok Med. Acad., Bialystok, Poland). 1972. CAROTENOIDS IN FISH I. CAROTENOIDS IN THE EGGS OF Acipenser ruthenus ruthenus L. (ACIPENSERIDAE) FROM THE DANUBE. Hydrobiologia, 39(1): 9-16.

The author investigated the presence of various carotenoids in the unfertilized eggs of the Acipenser ruthenus ruthenus L. (Acipenseridae) and "caviar" by means of columnar and thin-layer chromatography. The investigations revealed the presence of the following carotenoids: a. In the eggs Acipenser ruthenus ruthenus: β-carotene, astaxanthin ester, tunaxanthin, lutein and zeaxanthin. b. in the "caviar": isozeaxanthin, astaxanthin ester, lutein, zeaxanthin, taraxanthin and astaxanthin. (Auth. summ.)

14793. Johnson, Paul W., John McN. Sieburth, Akella Sastry, C. R. Arnold, and Maxwell S. Doty. (Dept. of Bacteriology and Biophysics, and Grad. School of Oceanogr., Univ. of R. I., Kingston, Rhode Island). 1971. Leucothrix mucor INFESTATION OF BENTHIC CRUSTACEA, FISH EGGS, AND TROPICAL ALGAE. Limnol. & Oceanogr., 16(6): 962-969.

Appendages and eggs of benthic marine crustacea are often populated with the characteristic filaments of the bacterium Leucothrix mucor. Planktonic crustacea and fish eggs free of L. mucor become infested when held in aquaria in the absence of antibiotics. Isolates from these organisms are grossly indistinguishable from isolates from algae. Although L. mucor is not a pathogen, it may be involved in high mortalities by causing pelagic eggs to sink below the surface and by interfering with the filtering apparatus of larval forms. Antibiotics that prevent development of L. mucor (and other microorganisms) reduce the mortality in developing eggs and larvae. Direct microscopic examination of 48 seaweeds from the lagoon at Majuro Atoll in the Marshall Islands for L. mucor indicated its presence on 81% of the samples. When 18 randomly chosen samples were put in enrichment culture, detection increased to 100%. These observations are at variance with a previous report that L. mucor is either absent or rare in warm waters. (Authors)

14794. Peterson, G. L., and Z. H. Shehader (Oceanic Inst., Makapuu Oceanic Center, Waimanalo, Hawaii). 1971. SUBPOPULATIONS OF THE HAWAIIAN STRIPED MULLET Mugil cephalus: ANALYSIS OF VARIATIONS OF NUCLEAR EYE-LENS PROTEIN ELECTROPHEROGRAMS AND NUCLEAR EYE-LENS WEIGHTS. Marine Biology, 11(1): 52-60.

The method of electrophoretic separation of nuclear eye-lens proteins was applied to a study of the population structure of the striped mullet Mugil cephalus L. in Hawaii. Electropherograms produced 5 pattern types, with most variations due to non-developmental genetic polymorphism. Some variations, however, were associated with size, and an ontogenetic basis was considered. The frequencies of the pattern types were significantly ($p < 0.005$) independent among the three geographical subpopulations examined: Kaneohe Bay, Oahu; Diamond Head, Oahu; and Kawaihae Bay, Hawaii. Growth rates of mullet eye-lens nuclei demonstrated significant ($p < 0.05$) differences between sexes and localities, except for Kaneohe Bay males versus Diamond Head males, which were nearly significant ($p \sim 0.075$). These variations in eye-lens nuclei growth rates are probably regulated by genetic factors. Nearly complete genetic isolation is evident for the three sub-populations of mullet in the Hawaiian Islands. The occurrence of genetic interchange is apparently less frequent between the Oahu and Hawaii populations than between the two Oahu populations, in accordance with their respective geographical distances. (Authors)

14795. Stelzer, R., H. Rosenthal, and D. Siebers (Inst. für Hydrobiologie und Fischereiwissenschaft der Universität Hamburg, Hamburg, Germany (FRG). 1971. INFLUENCE OF 2,4-DINITROPHENOL ON RESPIRATION AND CONCENTRATION OF SOME METABOLITES IN EMBRYOS OF THE HERRING Clupea harengus. (Einfluss von 2,4-Dinitrophenol auf die Atmung und die Konzentration einiger Metabolite bei Embryonen des Herings Clupea harengus.) Marine Biology, 11(4): 369-378. In German with English abstract.

In rearing experiments with herring eggs (temperature = 14.0° ± 0.1°C; salinity = 15 o/oo), oxygen consumption under normal conditions and after addition of 2,4-DNP (concentration = 0.1 mM/l; pH = 8.1) was measured over the period of embryonic development by means of the Warburg-technique. Additionally, the concentration of low molecular sugars, polysaccharides, free amino-acids, and adenosintriphosphate (ATP) was determined. The oxygen consumption increases during embryonic development; this increase is not linear. Periods of high intensity of oxygen consumption are followed by others with only slight increase. Immediately before hatching, the respiration curve distinctly declines. Under the influence of 2,4-DNP (dinitrophenol), the embryos increase their respiration intensity after a short period of incubation. The maximum rise in percentage over the normal values reaches up to 400% at the beginning of gastrulation, falls to 50% even before the locking of the blastopore, and decreases slightly to about 30% until hatching. The immense decline in the percentage increase in respiration following the addition of 2,4-DNP at the end of the first day of development is caused by the rapid increase in normal respiration. After poisoning with DNP at different stages of development, the uncoupled respiration curves are normally almost equal. This holds both for the temporal position of the respiration maxima (about 12 to 24 h after poisoning), and for the absolute amounts of the increased respiration over the normal values (5 to 7 µl/h/100 embryos). Excluded from these regularly repeated findings are two stages of development: (1) the stage of epiboly after exceeding the yolk equator until shortly before locking of the blastopore (26 to 32 h after fertilization at 14° C); (2) the period at the end of the 4th day of development when the eyes become pigmented (100 to 120 h after fertilization). These two stages are characterized by the fact that, at the moment of poisoning, the normal respiration shows retarded activity. On the other hand, these two stages are well able to undergo periods of development in which long-living embryonic deformations can occur after uncoupling of respiration with 2,4-DNP. The content in low molecular sugars and polysaccharides decreases slightly in the course of embryonic development and, following the addition of 2,4-DNP, decreases considerably during the first 24 h. After 48 h, accelerated decomposition of carbohydrates continues. Under the influence of 2,4-DNP, the embryos metabolize more carbohydrates in 1 day than during the whole normal development period. The changeover of the metabolism to increased decomposition of carbohydrates can be explained as a dislocation of the energetic sources from the respiration chain to glycolytic phosphorylation. In accordance with these facts, the concentration of free amino-acids, almost equal during normal embryonic development, remains unchanged under the influence of 2,4-DNP. (Authors)

14796. Reinert, Robert E. (Great Lakes Fish. Lab., Bur. Comm. Fish., U. S. Dept. of Interior, Ann Arbor, Michigan). 1970. PESTICIDE CONCENTRATIONS IN GREAT LAKES FISH. Pesticides Monitoring Journal, 3(4): 233-240.

During the past 4 years the Ann Arbor Great Lakes Fishery Laboratory of the Bureau of Commercial Fisheries has been monitoring insecticide levels in fish from the Great Lakes. The two insecticides found in all Great Lakes fish have been DDT (DDT, DDD, DDE) and dieldrin. Fish from Lake Michigan contain from 2 to 7 times as much of these insecticides as those from the other Great Lakes. Insecticide levels calculated on a whole-fish basis show a marked difference from species to species. Within a species there is also an increase in DDT and dieldrin levels with an increase in size. If these insecticide levels are, however, calculated as ppm of insecticide in the extractable fish oil, the differences in concentration between species and the differences between size groups becomes considerably less. Laboratory experiments indicate that fish can build up concentrations of DDT and dieldrin at the parts-per-million level from parts-per-trillion concentrations in the water. (Auth.)

14797. Plumb, John A. (Dept. of Fish. and Allied Aquacultures, Auburn Univ., Auburn, Alabama). 1971. CHANNEL CATFISH VIRUS RESEARCH AT AUBURN UNIVERSITY. Agric. Exp. Sta., Auburn Univ. Progress Report Series No. 95, 3 p.

Channel catfish virus (CCV) research at Auburn University Agricultural Experiment Station primarily involves development of methods for detecting the disease in carrier populations. Data collected to date indicate that methods used in detection of infectious pancreatic necrosis (IPN) virus and viral hemorrhagic septicemia (VHS) of trout are not applicable to CCV. High CCV neutralization indices were found in 52 channel catfish broodstock suspected of being virus carriers but no viable virus was isolated. The principal organs involved in fingerling channel catfish infected with CCV are kidney, liver and intestine although the muscle and brain yielded detectable virus. (Auth. summ.)

14798. Fearnhead, E. A., and B. C. Fabian (Oceanographic Research Inst., Durban, Union of South Africa). 1971. THE ULTRASTRUCTURE OF THE GILL OF Monodactylus argenteus (A EURYHALINE TELEOST FISH) WITH PARTICULAR REFERENCE TO MORPHOLOGICAL CHANGES ASSOCIATED WITH CHANGES IN SALINITY. South African Assoc. for Mar. Biol. Res., Oceanogr. Res. Inst. Investigational Report No. 26, 39 p.

The ultrastructure of the gill filaments of Monodactylus argenteus (a euryhaline teleost fish) was studied, with particular reference to changes in salinity. In general the findings from this study confirm the findings of previous workers, and lend support to the original Keys-Willmer hypothesis which assigns a salt-secretory role to a specialized secretory cell (the chloride cell) in the teleost gill. Another cell in the gill filaments that is apparently also involved in osmoregulation is described. (Authors)

14799. Metcalf, Robert A., Gregory S. Whitt, William F. Childers, and Robert L. Metcalf (Dept. of Zool., Univ. of Ill., Urbana, Illinois). 1972. A COMPARATIVE ANALYSIS OF THE TISSUE ESTERASES OF THE WHITE CRAPPIE (Pomoxis annularis Rafinesque) AND BLACK CRAPPIE (Pomoxis nigromaculatus Lesueur) BY ELECTROPHORESIS AND SELECTIVE INHIBITORS. Comp. Biochem. Physiol., 41(1B): 27-38.

The multiple forms of soluble esterases were compared for the brain, liver and skeletal muscle of the white and black crappie. The two species exhibited a high tissue specific gene function. No soluble cholinesterase activity was found; however, carboxylesterase, arylesterase and acetylesterase activity was present. The esterases of the brain and liver were similar between species in terms of multiplicity, substrate utilization and inhibitor sensitivity. However, the skeletal muscle of the white crappie contained esterase bands inhibited by p-HMB (arylesterase) whereas the black crappie did not. The inhibitory properties of fourteen organophosphate and carbamate compounds were compared for the esterases of the two species. (Authors)

14800. Parsnitskaja, A. I., V. A. Rasskazov, and G. D. Berdyshev (Inst. of Biologically Active Substances, F. E. Sci. Center, A.S. U.S.S.R., Vladivostok 22, USSR). 1972. PURIFICATION AND SOME PROPERTIES OF RIBONUCLEASE FROM THE LIVER OF Oncorhynchus gorbuscha Walb. Comp. Biochem. Physiol., 41(1B): 263-275.

An acid ribonuclease with optimum pH 5.3-5.5 was isolated from the liver of Oncorhynchus gorbuscha Walb. The enzyme was activated by divalent cations (Mg^{2+}, Ca^{2+}, Mn^{2+}) and inhibited by cations Cu^{2+} and Zn^{2+}. An acid ribonuclease from O. gorbusha liver was a thermolabile enzyme with a molecular weight 14,000. The enzyme had specificity to the secondary structure of RNA and preferentially degraded despiralized areas of RNA. (Authors)

14801. Wiggs, Alfred J. (Dept. of Zool., Univ. of Alberta, Edmonton, Alberta, Canada). 1971. SEASONAL CHANGES IN THE EXTRATHYROIDAL DISTRIBUTION OF IODIDE IN THE TELEOST FISH THE BURBOT, Lota lota L. Can. J. Zool., 49(12): 1505-1511.

The distribution of radioactivity in tissues of adult burbot weighing 1 to 3 kg

was determined by measuring the T/S ratio (tissue radioactivity/serum radioactivity) at intervals after the injection of radioiodide. In one instance the skin which comprises 12% of body weight of the burbot showed a T/S ratio of 29.3 and accounted for up to 27% of the injected dose of radioiodide. By comparison, in another study, the thyroid showed a T/S ratio of 5.2, representing 2.2% of the injected dose at 9.5C. The radioactivity (T/S ratio) in the skin increased until 30 h after injection and then declined. Non-radioactive iodide values of skin and serum were determined on a natural population over the course of a year. Values for skin iodide ranged from 227 μg/100 g to 816 μg/100 g while serum iodide values ranged from 7 μg/100 ml to 30 μg/100 ml. These values also indicate the magnitude of seasonal variation, which, in the case of serum iodide concentration, parallels the seasonal changes in lake temperature. (Auth.)

14802. Steele, Robert G., and Miles H. A. Keenleyside (Dept. of Zool., Univ. of Western Ontario, London, Ontario, Canada). 1971. MATE SELECTION IN TWO SPECIES OF SUNFISH (Lepomis gibbosus AND L. megalotis peltastes). Can. J. Zool., 49(12): 1541-1548.

The reactions of 20 male and 20 female pumpkinseed (Lepomis gibbosus) and longear sunfish (L. megalotis peltastes) to conspecifics and heterospecifics of the opposite sex were studied. Female pumpkinseeds showed a preference for conspecific males in the absence of visual cues; female longears showed a preference for conspecific males when both types of male could be seen. Males of both species did not discriminate between the two kinds of females in either the presence or absence of visual cues. Female choice of a conspecific spawning partner may be an important ethological isolating mechanism between these two species. A mechanism for hybridization between them is proposed. (Authors)

14803. Chua, Dixie, and J. G. Eales (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1971. THYROID FUNCTION AND DERMAL PURINES IN THE BROOK TROUT, Salvelinus fontinalis (Mitchill). Can. J. Zool., 49(12): 1557-1561.

Both TSH and thyroid powder significantly increased skin guanine and hypoxanthine levels over a 5-week period at 15°C. TSH was more effective than thyroid powder. Injected thyroxine as low as 0.05 μg/g body weight per 2 days and ambient thiourea as low as 0.0001% inhibited thyroid function over 3 weeks at 10°C. This thyroxine treatment did not significantly increase skin purine levels, but thiourea as low as 0.01% significantly decreased skin hypoxanthine and total purine levels. (Authors)

14804. Bartnik, V. G. (Dept. of Zool., Univ. of Br. Columbia, Vancouver, British Columbia, Canada). 1972. COMPARISON OF THE BREEDING HABITS OF TWO SUBSPECIES OF LONGNOSE DACE, Rhinichthys cataractae. Can. J. Zool., 50(1): 83-86.

Reproductive behavior of the longnose dace, Rhinichthys cataractae dulcis, from Alouette River, British Columbia, is described and compared with the eastern subspecies, Rhinichthys cataractae cataractae. Color differences between breeding males of the two subspecies are striking. Rhinichthys c. cataractae males display bright crimson patches on the ventral surface but these are lacking in R. c. dulcis males. The former breeds during daylight while the latter breeds at night. Although breeding behavior patterns of the two subspecies are almost identical, slight differences do exist and are correlated with diurnal versus nocturnal breeding. (Auth.)

14805. Beamish, F. W. H. (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1972. RATION SIZE AND DIGESTION IN LARGEMOUTH BASS, Micropterus salmoides Lacépède. Can. J. Zool., 50(2): 153-164.

Organic dry weight, protein N, lipid, and energy of contents in the stomach of largemouth bass decreased curvilinearly with time after a meal of lake emerald shiners, Notropis atherinoides. Time to evacuate the stomach increased with ration size. The proportionate change in time for a given percentage of gastric emptiness was independent of ration size. Proportionately more protein N than

lipid was absorbed in the stomach. The pyloric caeca is an area of absorption particularly for protein N. In the intestine absorption of lipid was proportionately greater than that for protein N. Absorption efficiency of protein N, lipid, or energy did not differ significantly among the rations followed nor between the two size classes of bass. The overall geometric mean absorption efficiency for protein N was 95.7%, for lipid, 95.5%, and for energy, 89.6%. Initially the rate of absorption of protein N was highest for fish fed large rations. Differences in rate of absorption of lipid were not observed among the rations followed. (Auth.)

14806. Liang, J. K., and R. T. Lovell (Dept. of Fish. and Allied Aquacultures, Auburn Univ., Auburn, Alabama). 1971. NUTRITIONAL VALUE OF WATER HYACINTH IN CHANNEL CATFISH FEEDS. Hyacinth Control Journal, 9(1): 40-44.

A series of feeding trials were conducted for the purpose of biologically evaluating aquatic plants, primarily water hyacinth, as feedstuffs for channel catfish. By conditioning the fish and gradually increasing the level of plant meal 40% of meal in the diet was consumed, but with reluctance. Water willow was most palatable followed by water hyacinth, then, alligatorweed. The protein efficiency ratio of a protein concentrate from water hyacinth was 0.34 which was much lower than 4.87 for casein. The most feasible nutritional contribution of water hyacinth appears to be when the plant meal is fed as a low percentage in vitamin-poor diets as a source of growth factors. The addition of small quantities, 5 to 10%, of hyacinth meal in vitamin-free diets increased growth and reduced mortality of channel catfish fingerlings. Water hyacinth meal provided significantly higher weight gains and lower mortality than did commercial alfalfa meal when fed in a vitamin-free diet. It may be feasible to substitute the alfalfa meal with water hyacingh meal in feeds for catfish, assuming that alfalfa has nutritional value in these feeds. (Authors summ. and conclusions)

14807. Lutz, Peter L. (Dept. of Zool., Univ. of Glasgow, Scotland). 1972. EXTRACELLULAR SPACES AND COMPOSITION OF VARIOUS TISSUES OF PERCH. Comp. Biochem. Physiol., 41(1A): 77-88.

The inulin incubation technique was found not to be reliable for the measurement of perch tissue extracellular space. An injection method gave values not significantly different from chloride spaces. Intracellular values for the major electrolytes are given for muscle, liver and intestinal wall. Compared with muscle, liver and intestinal wall had high intracellular values for Na and Cl but similar amounts of K and Mg. Muscle chloride is present in much lesser quantities than that dictated by a K Donnan equilibrium and it is suggested that Cl is partially excluded from such cells. Comparing the perch tissue intracellular values with those of other vertebrates a remarkable constancy in Mg is noted (values ranging 14-16 mM/kg cell water). (Auth.)

14808. Lutz, Peter L. (Dept. of Zool., Univ. of Glasgow, Scotland). 1972. BODY COMPARTMENTALIZATION AND ION DISTRIBUTION IN THE TELEOST (Perca fluviatilis). Comp. Biochem. Physiol., 41(1A): 181-193.

The distribution of ions and body fluid compartments were studied in the perch. On comparing whole bone with pronase extracted bone large differences were found in Na and Cl content. This was thought to be due to the presence of a substantial extracellular phase in perch whole bone. Mineral bone had considerable amounts of bound Ca, Mg and Na. The whole body extracellular fluid is thought to be composed of two components, (a) a rapidly equilibrating phase (inulin space) and (b) a slowly equilibrating phase (Cl_{sp}-inulin space). The distribution of ions throughout the major body compartments is given and the results compared to other vertebrates. Major differences between groups are thought to result from the differing amounts and composition of bone throughout the Vertebrata. (Auth.)

14809. Pickering, Alan D., and Graham J. Dockray (Freshwater Biol. Assoc., The Ferry House, Far Sawrey, Ambleside, Westmorland, England). 1972. THE EFFECTS OF GONADECTOMY ON OSMOREGULATION IN THE MIGRATING RIVER LAMPREY: Lampetra fluviatilis L. Comp. Biochem. Physiol., 41(1A): 139-147.

Gonadectomy partially inhibited the normal breakdown of marine osmoregulation

in the migrating river lamprey by preventing degeneration of the intestine. The swallowing rates in 50% sea water for fresh-run and gonadectomized animals (maintained in fresh water for 2 months) were 122.3 and 125.2 ml/kg per day with intestinal absorption rates of 108.7 and 118.9 ml/kg per day. In contrast, sham-gonadectomized lampreys had a swallowing rate of 10.2 ml/kg per day with an intestinal absorption rate of 6.5 ml/kg per day. It is concluded that maturation of the gonads reduced the monovalent ion transporting properties of the intestine but the nature of the factors involved requires further investigation. (Authors)

14810. Packer, Randall K., and William A. Dunson (Dept. of Biol., The Pennsylvania State Univ., Univ. Park, Pennsylvania). 1972. ANOXIA AND SODIUM LOSS ASSOCIATED WITH THE DEATH OF BROOK TROUT AT LOW pH. Comp. Biochem. Physiol., 41(1A): 17-26.

Brook trout exposed to pH 2.00-3.50 (HCl) showed a considerable decrease in or a complete inhibition of O_2 consumption prior to death. Death from anoxia caused by KCN occurred in about the same time as death caused by exposure to very low pH (2.00, HCl). At low pH, trout suffered a massive loss of Na prior to death. The rate of net Na loss was inversely related to survival time. A saline medium (150 mM NaCl) had a protective effect, prolonging the life of trout at pH 3.25, but not at pH 2.00. The toxicity of H_2SO_4 (pH 3.25) was less than HCl of the same pH. Acid mine water was less toxic to brook trout than H_2SO_4. Despite differences in toxicity of solutions of HCl, H_2SO_4 and mine acid, survival time can be accurately predicted if the rate of net Na loss is known. The lethal effect of these acids appears to be due to inhibition of O_2 uptake and to a large increase in net Na loss. (Authors)

14811. Joy, James E. (Dept. of Vet. Parasitology, Coll. of Vet. Medicine, Texas A&M Univ., College Station, Texas). 1972. A NEW SPECIES OF Henneguya (MYXOSPORIDEA: MYXOBOLIDAE) FROM THE BLACK DRUM Pogonias cromis IN CLEAR LAKE, TEXAS. J. Protozool., 19(1): 126-128.

Henneguya texana n. sp. (Myxosporidea: Myxobolidae) is described from the gill filaments of 2 out of 47 specimens of marine sciaenid fish Pogonias cromis collected from Clear Lake, Texas. The spore body is 7-9 by 6-7 μ (mean 8.1 by 6.7 μ) with a thickness of 4-5 μ (mean 4.7 μ). The 2 fused, tapering caudal processes are 36-59 μ (mean 48.65 μ) long. The parasitized fish were collected in December 1970 and January 1971 were 168 and 482 mm in total length, respectively. (Auth.)

14812. Plumb, John A. (Dept. of Fish. and Allied Aquacultures, Auburn Univ., Auburn, Alabama). 1971. TISSUE DISTRIBUTION OF CHANNEL CATFISH VIRUS. Journal of Wildlife Diseases, Vol. 7, pp. 213-216.

The kidney, liver, intestine, brain, and muscle of live infected channel catfish were assayed for channel catfish virus in channel catfish gonad cell cultures. Sampling was done at 24-hour intervals for 120 hours. The virus was first detected in the kidneys of channel catfish 24 hours after inoculation. Channel catfish virus was also isolated at sequential time intervals from the intestine, liver, brain, and muscle. Virus was detected in the kidney, liver, and intestine but not the brain of the fish that died 70 hours after infection. (Auth.)

14813. Barlow, George W., and Victor L. de Vlaming. 1972. OVARIAN CYCLING IN LONGJAW GOBIES, Gillichthys mirabilis, FROM THE SALTON SEA. Calif. Fish and Game 58(1): 50-57.

The ovarian condition of the longjaw goby Gillichthys mirabilis, changes with the seasons in the Salton Sea. The protracted spawning period extends from December or January to June. Each female spawns more than once, and the population does not spawn synchronously. Regression of the ovaries starts by late June, and recrudescence begins in September or October. The timing of ovarian development at different localities in the lake varies slightly. Ovarian cycling appears to be correlated with temperature changes. (Authors)

14814. Lasker, Reuben, Richard H. Tenaza, and Lawrence L. Chamberlain. 1972 THE RESPONSE OF SALTON SEA FISH EGGS AND LARVAE TO SALINITY STRESS Calif. Fish and Game, 58(1): 58-66.

In laboratory experiments, Salton Sea water at salinities (S) of 40 °/oo and higher adversely affected developing embryos and larvae of the croaker, Bairdiella icistia, and the sargo, Anisotremus davidsoni. Embryos developed abnormally, hatching success diminished, and mortality of larvae was greater than in normal Salton Sea water at 37.6 °/oo S. (Authors)

14815. Shaw, Stanton B. 1972. DDT RESIDUES IN EIGHT CALIFORNIA MARINE FISHES. Calif. Fish and Game, 58(1): 22-26.

Levels of DDT, DDD, DDE, and total DDT residues in the livers and flesh of marine fishes, mainly from Monterey Bay, were determined using gas-liquid chromatography. Mean values for total DDT residues for liver ranged from 4.7 ppm wet weight (rough scale rattail) to 0.22 ppm (lingcod), and for flesh ranged from 2.0 ppm (sablefish) to 0.035 ppm (lingcod). Maximum values for total DDT residues in some individual fishes approached or exceeded FDA limits of 5.0 ppm wet weight, e.g., for livers: sanddab 13 ppm, roughscale rattail 7.9 ppm, sablefish 6.9 ppm, English sole 6.1 ppm, and petrale sole 4.8 ppm; for flesh: sablefish 6.3 ppm and roughscale rattail 4.7 ppm. (Auth.)

14816. Lea, Robert N. 1972. SOUTHERN GEOGRAPHICAL RECORDS FOR FOUR SURFPERCHES, FAMILY EMBIOTOCIDAE, WITH NOTES ON A POPULATION RESURGENCE OF THE SHARPNOSE SEAPERCH. Calif. Fish and Game, 58(1): 27-31.

Southern range extensions are given for the silver surfperch, the rubberlip seaperch, and the shiner perch. A fourth species, the sharpnose seaperch, is recorded from a new locality off Baja California, Mexico and helps to substantiate a previous questionable record. Data on increasing numbers of sharpnose seaperch in Monterey Bay and southern California are given and it appears that this species is undergoing a population resurgence. (Auth.)

14817. Briggs, Kenneth T., and C. William Davis. 1972. A STUDY OF PREDATION BY SEA LIONS ON SALMON IN MONTEREY BAY. Calif. Fish and Game, 58(1): 37-43.

There have been no studies which could serve to demonstrate the extent of sea lion predation on salmon (Oncorhynchus sp.) in Monterey Bay, California. Observations of fishing operations in Monterey Bay during the 1969 commercial salmon season showed that California sea lions (Zalophus californianus Lesson) preyed upon about 4% of all salmon hooked from the boats sampled. In addition, California sea lions were also seen holding seven salmon which they had not taken from fishermen's lines. Sea lions were seen more frequently in the southern half of Monterey Bay in the early season and were concentrated in the northern half in August and September. (Authors)

14818. Nuorteva, Pekka, and Erkki Hasanen (Zool. Mus., Univ. of Helsinki, Helsinki, Finland). 1971. OBSERVATIONS ON THE MERCURY CONTENT OF Myoxocephalus quadricornis (L.) (TELEOSTEI, COTTIDAE) IN FINLAND. Annales Zoologici Fennici, 8(3): 331-335.

The mercury content was determined in the fourhorn sculpin, a glacial relict occurring in the Baltic and in some lakes. In an unpolluted area of the Baltic, the mercury content varied between 0.06-0.36 ppm, being positively correlated with size. In the stunted specimens of Lake Ladoga the content was the same as in the largest specimens in the Baltic - obviously because their ages were identical and hence also the possibility for bioaccumulation. In the mercury-polluted lake Päijänne the mercury content of M. quadricornis was elevated, values up to 1.9 ppm being found. In another lake, Näsijärvi, with the same degree of mercury pollution, however, the mercury contamination of M. quadricornis was very low (0.02-0.28 ppm), possibly because the oxygen content of its deeps is so low that mercury is not microbially transformed to the bioaccumulating methyl mercury. (Authors)

14819. Rawstron, Robert R. 1972. HARVEST, SURVIVAL, AND COST OF TWO DOMESTIC STRAINS OF TAGGED RAINBOW TROUT STOCKED IN LAKE BERRYESSA, CALIFORNIA. Calif. Fish and Game, 58(1): 44-49.

Tagged rainbow trout of the Coleman Kamloops strain and the Mt. Whitney strain were planted in Lake Berryessa, Napa County, California. The former was less vulverable to shore anglers shortly after planting and had a more rapid limnetic distribution, equal mean annual harvest rates, a higher survival, and a lower cost to the angler's creel compared to the latter. (Auth.)

14820. Nagahisa, Eizo, and Yasuhiko Tsuchiya (Dept. of Fish. Fac. of Agric., Tohoku Univ., Sendai, Japan). 1971. STUDIES ON THE RAINBOW TROUT ALDOLASE. II. PHYSICO-CHEMICAL PROPERTIES AND AMINO ACID COMPOSITION OF RAINBOW TROUT MUSCLE ALDOLASE. Tohoku J. agric. Res., 22(1): 46-55.

The ultraviolet absorption of rainbow trout muscle aldolase has a maximum at 283 mμ in phosphate buffer (pH 7.5) and 293 mμ in 0.1 N NaOH solution. Extinction at 280 mμ is 0.90 for 0.1 percent of protein concentration. The E_{280}/E_{260} ratio is 2.22 for the pure enzyme. The sedimentation coefficient of rainbow trout muscle aldolase is 7.6 S and molecular weight is estimated to be about 155,000 to 160,000 by using this coefficient and sephadex G-200 chromatographic data. Amino acid composition of rainbow trout muscle aldolase is slightly different from mammalian aldolase. But the amounts of lysine, histidine, and tyrosine which are essential to the catalytic activity of the rabbit enzyme were also equivalent to those of rainbow trout muscle aldolase. In the ultracentrifugal experiment of dissociated aldolase, single symmetrical boundaries were observed at 8 M urea solution, 3 M guanidium hydrochloride solution and maleyl aldolase with the sedimentation coefficients of 1.6S, 1.7S and 2.1S, respectively. It is suggested from these values that the monomer is about one fourth of the parental fish enzyme in molecular weight. The maleyl aldolase of rainbow trout moves identically in migration with that of rabbit and has three protein bands in starch gel and polyacrylamide gel disc electrophoreses. (Authors summ.)

14821. Sumari, Olli. 1971. STRUCTURE OF THE PERCH POPULATIONS OF SOME PONDS IN FINLAND. Annales Zoologici Fennici, 8(3): 406-421.

The fish populations of 32 oligotrophic Finnish ponds, 0.6-64 ha in size and most of them without outlets, were poisoned by rotenone, and the numbers and biomasses of the fish species were calculated. Age determinations of perch, made chiefly by the scale method, proved difficult, but the mean lengths of one-, two-, and three-summer-old perch were estimated as 5.6, 9.5, and 12.4 cm, respectively. In one pond all the perch were six summers old and of the same size, in others the age groups were uniformly represented. During the first few summers the growth rate is the same as in larger waters, but later on it slows down and may nearly cease. The very different growth rates are probably correlated with the availability of food. Since the growth rate of the older perch was high if perch young were available, it is concluded that the young form an important part of the food. The average biomass of perch in the ponds investigated was 11.9 (1.8-41.3) kg/ha. In ponds with a high number of one-summer-old perch the biomass was smaller on the average than in ponds with few or no young. A new age group usually forms when there are few mature perch. The biomass of perch was significantly smaller in ponds with a reproducing roach population than in ponds without roach. The biomass of perch tends to decrease with increasing number of fish species. It is concluded that the size of each age group and the variation in the perch biomass mainly depend on the size and composition of the populations of perch and other fish. Although many mechanisms may be involved, the main factors affecting the perch populations in the ponds studied are biotic - predation upon perch young by perch, roach, pike and burbot, and the availability of suitable food. (Auth.)

14822. Hakala, Ilpo (Lammi Biol. Sta., Univ. of Helsinki, Lammi, Finland). 1971. A NEW MODEL OF THE KAJAK BOTTOM SAMPLER, AND OTHER IMPROVEMENTS IN THE ZOOBENTHOS SAMPLING TECHNIQUE. Annales Zoologici Fennici, 8(3): 422-426.

Two multiple-unit versions of the Kajak type corer are described, one with six units and the other with three units and an automatic releasing mechanism. Both corers are made of polyvinylchloride and brass. A slicing device for use with the corers was designed to permit study of the vertical distribution of the zoobenthos. Further, a sieving technique especially suited for the study of the zoomeiobenthos is described, in which the sieving residue can be studied with the aid of a movable grooved disc in which the entire width of each groove is visible simultaneously at a magnification suitable for the study of the meiofauna. Detailed diagrams of the construction of these improvements are presented. It is suggested that the relatively large number of animals per unit area obtained with the aid of the technique described is chiefly due to the fact that, as in the original model, the tube corers do not disturb the surface layer of the bottom, where the density of zoobenthos is highest. (Auth.)

14823. Uchida, Naoyuki (Lab. of Biochem., Fac. of Fish., Hokkaido Univ., Hakodate, Japan). 1971. CHROMATOGRAPHIC BEHAVIORS OF PROTEOLYTIC ENZYMES IN CHUM SALMON PYLORIC CAECA ON SEPHADEX GEL CHROMATOGRAPHY. Bull. Fac. Fish. Hokkaido, 21(4): 305-314. In Japanese with English Abstract.

The proteolytic enzymes in chum salmon pyloric caeca showed different chromatographic patterns on the Sephadex G-100 column (2.5 X 100 cm) depending upon the buffers used. By using a 0.2 M borate buffer containing 1 mM $CaCl_2$ pH 8.7 (II), two high proteolytic activities were found, whereas by using a 10 mM Tris-HCl buffer containing 5 mM $CaCl_2$ and 0.05 M NaCl, pH 8.8(I), only one major proteolytic activity was observed on gel chromatography. Chromatographic patterns of the enzyme were observed interconvertibly by replacing two kinds of buffers (Tris, I and borate, II) on the Sephadex gel column. Two fractions of high proteolytic activity obtained from gel chromatography with a borate buffer clearly showed different mobilities on cellulose acetate electrophoresis. As the corresponding fractions on electrophoresis were also identified in the original proteolytic enzymes, it was ascertained that both proteolytic active fractions isolated on gel chromatography would not be artifacts which might be produced during procedure of preparing enzymes. From these results, it could be assumed that the Sephadex gel chromatography with a borate buffer would be one of the useful methods for purifying the proteolytic enzyme extracted from the chum salmon pyloric caeca. (Auth.)

14824. Okada, Shun, and Akira Taniguchi (Lab. of Marine Zool., Fac. of Fish., Hokkaido Univ., Hakodate, Japan). 1971. SIZE RELATIONSHIP BETWEEN SALMON JUVENILES IN SHORE WATERS AND THEIR PREY ANIMALS. Bull. Fac. Fish. Hokkaido, 22(1): 30-36. In English.

The stomach contents of 94 chum and 43 pink juvenile salmon, Oncorhynchus keta and O. gorbuscha sampled by the trap set-nets in the shore waters near Mori and Usujiri, southern Hokkaido, during the period from May 28 to June 13, 1970 were examined. Small-size prey animals such as micro-copepods, young Parathemisto spp., decapods zoea and insects were the food for juveniles smaller than 55 mm in fork length and large-size prey animals such as adults of Parathemisto japonica and euphausiids for juveniles larger than 55 mm. The body width of the largest prey animals eaten by various size juveniles (36-104 mm in fork length) ranged from 0.5 mm to 3.8 mm. The size of the largest diet eaten by juveniles changed rapidly from a small-size group to a large-size group when the predators attained to about 55 mm in fork length. Pre- or post-larvae of one species of pricklebacks also seemed to be important preys for both small and large juveniles in shore waters. (Authors summ.)

14825. Brett, J. R., D. B. Sutherland, and G. D. Heritage (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, Br. Columbia, Canada). 1971. AN ENVIRONMENTAL-CONTROL TANK FOR THE SYNCHRONOUS STUDY OF GROWTH AND METABOLISM OF YOUNG SALMON. Fish. Res. Bd. Canada Technical Report No. 283, 27 p.

A 40-gallon fiberglas tank with suitable temperature, oxygen and flow controls is described for use in determining energy budgets of small fish. (Authors)

14826. Shimazaki, Kenji (Res. Inst. of No. Pacific Fish., Hokkaido Univ., Hakodate, Japan). 1971. NOTES ON BIOLOGICAL CHARACTERISTICS AND MIGRATION OF THE MASU SALMON, Oncorhynchus masou (Brevoort), IN THE OFFSHORE AREAS OF THE WEST COAST OF KAMCHATKA PENINSULA. Bull. Fac. Fish. Hokkaido, 22(1): 37-46. In Japanese with English abstract.

From 1966 to 1970, a gill net was spread in the offshore areas of the west coast of Kamchatka Peninsula to catch salmon by the research boat "Kosho Maru No. 5" (1966-1968) and the "Oyashio Maru" (1969-1970). In June, some masu salmon (Oncorhynchus masou) were caught together with other species of the genus Oncorhynchus. In this paper, the author deals with information obtained from the measurement of the biological characteristics of the samples from 1968 to 1970 and from the migration of the masu salmon. Masu salmon are concentrated in the waters south of 53°N. The center of distribution was located off the west coast of Kamchatka Peninsula. The average of catch per unit of effort declined rather markedly from the maximum recorded in early June. The average fork length is approximately 45 to 46 centimeters. No significant difference was found between the fork lengths of males and females. The fork length of the males showed greater variation than that of the females. The proportion of females was 62.4% (58.6-68.3%). The maturity indices (ratio of gonad weight to body weight) were 6 to 7% (90-110 gr.) for females and about 2% (25-40 gr.) for males. It may be considered that the natal streams of the masu salmon in this area are located along the west coast of the Kamchatka (from the Bolishaya River to the Icha River). In this area hooks used for the long-line were found in the mouth of some of the masu salmon. These were apparently the same kind of hooks as are used only in the Japan Sea south of Hokkaido. These data seem to indicate that the masu salmon in the west coast of the Kamchatka migrate from the Japan Sea. (Auth.)

14827. Kanno, Yasuji, and Ikuso Hamai (Lab. of Biol. of Fish Population, Fac. of Fish., Hokkaido Univ., Hakodate, Japan). 1971. FOOD OF SALMONID FISH IN THE BERING SEA IN SUMMER OF 1966. Bull. Fac. Fish. Hokkaido, 22(2): 107-128. In Japanese with English abstract.

Stomach contents of three species of salmon, viz. chum (Oncorhynchus keta), sockeye (O. nerka), and pink (O. gorbuscha), caught in 30 fishing stations in the Bering Sea in June and July, 1966, were studied. There were great differences in the composition of food organisms among three species and among the areas in which the fish were caught. The chum salmon does not eat squid, while the sockeye and the pink salmon do not eat copepod or pteropod. Comparing the food compositions of three salmon species, the rank of preference of each food organism was deduced as follows. Chum salmon: (1) amphipod, euphausiid, pteropod, copepod (2) fish (3) squid larvae. Sockeye and pink salmon: (1) squid (2) fish, amphipod, euphausiid (3) others. The extent of feeding satiety was estimated from the comparison with the largest food weight contained in the stomach as follows: (1) sockeye salmon (about 130 grams) (2) pink salmon (about 80 grams) (3) chum salmon (about 60 grams). The variation of the food weight per fish at all sampling stations was the largest in the case of the sockeye salmon and the smallest in the chum salmon. Comparing the percentage of empty stomachs, it was significantly found out that the sockeye salmon had a higher percentage of empty stomachs than the chum salmon, and that the percentage was different according to the areas in the case of the chum and the sockeye salmon. Furthermore a significant correlation between the percentage of empty stomach and the number of fish caught per unit net length was observed in the sockeye salmon. The differences in food weight and the percentage of empty stomach might associate with the availability of food organisms. The Spearman rank correlation coefficient of food compositions in 10 fishing stations in which the three species were simultaneously caught showed that the degree of similarity of food composition was the highest between the sockeye and the pink salmon and the lowest between the chum and the pink salmon.

14828. Ota, Toru, and Minoru Yamada (Lab. of Chem. of Fish Oil, Fac. of Fish., Hokkaido Univ., Hakodate, Japan). 1971. LIPIDS OF Masu SALMON Oncorhynchus masou. I. VARIATION OF THE LIPID CONTENT AND THE FATTY ACID COMPOSITION OF JUVENILE Masu SALMON DURING THE PERIOD OF SMOLT-TRANSFORMATION, AND ON THE INFLUENCE OF LIGHT UPON THOSE VARIATIONS. Bull. Fac. Fish. Hokkaido, 22(2): 151-158. In Japanese.

The purpose of this work was to investigate the variations of the lipid content and the fatty acid composition in the muscle of the cultivated juvenile Masu salmon during the period of smolt-transformation, and the influence of light upon those variations. The lipid content of the control group decreased rapidly at the mid-smolt stage, but remained almost unchanged from the mid-smolt stage to the post-smolt stage. On the contrary, the lipid content of the illuminated group was held constant from the pre-smolt stage to the mid-smolt stage, but decreased gradually from the mid-smolt stage to the post-smolt stage and it was smaller than that of the control group at the post-smolt stage. The contents of the total saturated and monoenoic acids decreased from the pre-smolt stage to the post-smolt stage in both groups. Especially, the rate of the decrease of the total monoenoic acids was greater in the illuminated group than in the control group at the post-smolt stage. It was estimated that hexadecanoic acid and octadecenoic acid were mainly used as the source of energy during the period of smolt-transformation. The fact that light accelerates transformation of the juvenile Masu salmon at the early stage, but delays it at the latter stage in the period of smolt-transformation, also became clear from the variations of the lipids in the muscle of the juvenile Masu salmon.

14829. Ogawa, Akira, Koichi Zama, and Hisanao Igarashi (Lab. of Food Chem., Fac. of Fish., Hokkaido Univ., Hakodate, Japan). 1971. CONJUGATED LIPIDS OF THE RED SALMON KIDNEY. (LIPIDS OF SALMONOID FISHES XI). Bull. Fac. Fish. Hokkaido, 22(2): 159-167. In Japanese.

Conjugated lipids were prepared from the red salmon kidney. The chromatographic resolution of these conjugated lipids confirmed the presence of phosphatidyl choline, amino-phospholipids and sphingomyelin as major components, and also the acetal types of ethanolamine phospholipids and choline phospholipids as minor ones. The fatty acids of PC and PE comprised a large amount of palmitic and octadesenoic acid, together with a small amount of stearic, eicosenoic, eicosapentaenoic and docosahexaenoic acid. Phosphatidyl choline and PE were hydrolyzed by snake venom phospholipase A for the determination of the fatty acid distribution between the two positions. Saturated fatty acids were predominantly present at the α-ester position, and unsaturated fatty acids, e.g. octadecenoic acid etc. were also present. Octadecenoic, eicosenoic, eicosapentaenoic and docosahexaenoic acid were the main components of the β-attached fatty acids. The fatty acids of sphingomyelin comprised a large amount of tetracosenoic acid, with a small amount of miristic, palmitic and docosenoic acid.

14830. Yamada, Juro (Fac. of Fish., Hokkaido Univ., Hakodate, Japan). 1971. A FINE STRUCTURAL ASPECT OF THE DEVELOPMENT OF SCALES IN THE CHUM SALMON FRY. Bull. Jap. Soc. sci. Fish., 37(1): 18-29. In English.

Early phases of scale development in the chum salmon (Oncorhynchus keta) were studied by electron microscopy. The osseous matrix, composed of fine collagenous fibrils and dense ground substance, is secreted from cells of the scale papilla aggregated in the subepidermal connective tissue. The presence of dilated cisternae of the granular endoplasmic reticulum, rather numerous mitochondria, and abundant free ribosomes characterizes these osteogenic cells. Calcification of the matrix begins with the appearance of clusters of needle-shaped hydroxyapatite crystallites being limited within small dense particles scattered in the matrix. As the calcification progresses, they increase in number as well as in size. Thick collagen fibrils are added onto the lower surface of the calcified osseous layer by another kind of cells to form the fibrillary plate. These cells, rectangular in form, are characterized by a parallel array of highly extensive granular endoplasmic reticulum and well-developed Golgi zones with lysosomal bodies. The scale ridge arises as a partial thickening of the osseous layer. The

ridge in cross section appears to be formed when an upper osteogenic cell is overlaid obliquely by the adjacent outer cell in the process of flattening of cells of the scale margin.

14831. Yamamori, Kunio, Isao Hanyu, and Takashi Hibiya (Dept. of Fish., Fac. of Agric., the Univ. of Tokyo, Bunkyo-ku, Tokyo, Japan). 1971. MONOPOLAR LEAD OF ELECTROCARDIOGRAMS FROM THE BODY SURFACE OF THE EEL. Bull. Jap. Soc. sci. Fish., 37(2): 90-93. In Japanese.

Methods to record the ECGs from the skin of the eel, Anguilla japonica, were investigated. Monopolar recordings of the ECGs were successfully done, either when the fish was partly bathed, with the reference electrode placed in the water apart from the fish, or when an electrode designed similar to the Wilson's central terminal in human electrocardiography was used as the reference. Typically, QRS complex of the ECGs thus recorded was diphasic, being from negative to positive in the head region, and from positive to negative in the trunk region, while it showed triphasic or more complex patterns around the cardiac region. The amplitude was minimal at a dorsal position where the polarity of QRS reversed. In a fish held on a dry towel, the amplitude of QRS was almost constant over the whole surface except the vicinity of the heart. This indicates that even the tail is not the right place for the reference electrode in monopolar recording.

14832. Yamamori, Kunio, Isao Hanyu, and Takashi Hibiya (Dept. of Fish., Fac. of Agric., the Univ. of Tokyo, Bunkyo-ku, Tokyo, Japan). 1971. ELECTRO-CARDIOGRAPHY OF THE EEL BY MEANS OF UNDERWATER ELECTRODES. Bull. Jap. Soc. sci. Fish., 37(2): 94-97. In Japanese.

In the eel, Anguilla japonica, which has a heart with a strong electromotive force, the ECGs were found to be recordable by electrodes placed in the water apart from fish's body. An apparatus so devised that an "underwater electrode" was attached to either end of a plastic cylinder was submerged on the bottom of an aquarium. When the fish slipped into the cylinder, ECGs were easily recorded, being superimposed upon slow undulation of the base line caused by the respiratory movement of the fish. QRS complex of the ECG was marked, while P and T waves were identified with difficulty. The amplitude of QRS complex was about 0.5 mV. This method enabled us to observe the heart rate of the eel under least disturbed state. Ordinary heart rate was not quite regular. Very slight stimulation was enough to bring about cardiac inhibition, which was also accompanied by a considerable reduction in the amplitude of the QRS. After rough treatment, such as deep anaesthesia or exposure to air, the heart rate showed remarkable compensatory increase, reaching a value a few times higher than the normal level. In the American eel, A. rostrata, QRS was about 0.02 mV. This indicates that the electromotive force of the heart in this species is much smaller than in A. japonica.

14833. Ooshiro, Zentaro (Fac. of Fish., Kagoshima Univ., Shimoarata-cho, Kagoshima, Japan). 1971. STUDIES ON PROTEINASE IN THE PYLORIC CAECA OF FISHES - II. SOME PROPERTIES OF PROTEINASE PURIFIED FROM THE PYLORIC CAECA OF MACKEREL. Bull. Jap. Soc. sci. Fish., 37(2): 145-148. In Japanese.

Previously, the author reported on the purification results of proteinase from the pyloric caeca of mackerel by extraction with water, ammonium sulfate fractionation, DEAE-cellulose column chromatography and Sephadex gel filtration. In this paper, studies on some of the properties of this purified proteinase are reported. The purified mackerel proteinase has been ascertained to be most active at pH 9.0 and 43°C, with casein as substrate. And this proteinase hydrolysed no less than 70% of the peptide bond in casein; while crystalline bovine trypsin was hydrolysed only 15%. Therefore, mackerel proteinase differs also in this respect from the bovine trypsin, although the optimum pH and temperature of these two enzymes are almost similar. The purified proteinase appeared homogeneous on electrophoretic analysis. Finally, by filtration on Sephadex G-200 the elution volume of mackerel proteinase was determined and compared with those of other proteins of known molecular weight. From the elution volume the molecular weight of mackerel proteinase has been estimated to be 30,000.

14834. Aoe, Hiroshi, Isao Masuda, Isao Abe, Takashi Saito, and Yukiko Tajima (Central Lab. of Nisshin Flour Milling Co., 177, Tsurugaoka, Ohi, Irumagun, Saitama, Japan). 1971. WATER-SOLUBLE VITAMIN REQUIREMENTS OF CARP-VII. SOME EXAMINATIONS ON UTILITY OF THE REPORTED MINIMUM REQUIREMENTS. Bull. Jap. Soc. sci. Fish., 37(2): 124-129. In English.

The utility of reported data on the minimum requirements of vitamins was examined by testing the growth-promoting activity for young carp of a vitamin mixture representing them. The vitamin mixture failed to sustain the growth of carp, but could maintain the growth almost normally, when enriched with thiamine, riboflavin, and niacin. It is suggested that minimum requirements for these three vitamins, especially for niacin, are greatly influenced by the quantity of some other vitamins present.

14835. Yone, Yasuo, and Katumi Hirano (Dept. Fish. Fac. of Agric., Miyazaki, Japan). 1971. A BACTERIOLOGICAL STUDY ON THE DEATH OF FISH DURING TRANSPORTATION OR KEEPING AFTER TRANSPORTATION - I. THE CAUSE OF THE DEATH. Bull. Jap. Soc. sci. Fish., 37(2): 140-144. In Japanese.

In the previous report, Yone inferred that the death of fish during transportation or while keeping after transportation is mainly attributable to infection. The present study was carried out to demonstrate that the inference is correct. The present paper deals with the isolation of bacteria from the liver of red sea bream (Chrysophyrys major) which died during keeping after the "keep on closed system" and the pathogenicity of the isolates. The adding of chlortetracycline (CTC) and nitrofuran derivatives suppressed the increase of bacterial count and the consumption of dissolved oxygen by bacteria in the sea water in polyethylene cases. The mortality in the CTC group was lower than that in the non-added group. Numerous bacteria existed in the liver of dead fish in the non-added group, but bacteria were not detected in the liver in the CTC group. Of the isolates distinguished into thirteen groups, those belonging to groups V, IX, and X showed pathogenicity. Organisms belonging to group X were isolated from the majority of livers of dead fish in the non-added group and accounted for 87 percent of the total isolates from the liver. On the other hand, group V was isolated from only one. Organisms belonging to groups V and X were also isolated from the sea water in polyethylene cases of the non-added group. The conclusion that the death of fish during holding after being kept on a closed system is caused by infection due to pathogens is derived from the above results.

14836. Kono, Hideo, and Yukio Nose (Dept. of Fish., Fac. of Agric., Tokyo Univ., Bunkyo-ku, Tokyo, Japan). 1971. RELATIONSHIP BETWEEN THE AMOUNT OF FOOD TAKEN AND GROWTH IN FISHES - I. FREQUENCY OF FEEDING FOR A MAXIMUM DAILY RATION. Bull. Jap. Soc. sci. Fish., 37(3): 169-175. In Japanese.

When fishes are fed daily, the frequency of feeding which maximize the daily ration was examined in six species of fishes, namely, jack mackerel, Trachurus japonicus, goby, Chasmichthys gulosus, rockfish, Sebastes inermis, yakataisaki, Therapon jarbua, rainbow trout, Salmo gairdnerii irideus, and goldfish, Carassius auratus. The fishes were fed from 1 to 12 times a day for 10 days, seeing that at each feeding the fish reached satiation, and the daily rations were recorded. The following relationship appeared to exist between the frequency of feeding per day (T) and the daily rate of feeding (f): $f = C(1-e^{-mT})$ where C is the maximum daily rate of feeding and m is a constant which represents the rate of approach of the daily rate of feeding to its maximum. The value of m is determined by the ratio of the satiation amount at one feeding a day to the maximum daily ration. The daily ration seemed to be nearly maximized with 2 feedings for goby and yakataisaki, with 3 for rockfish and rainbow trout, with 4 for jack mackerel, and with 12 for goldfish.

14837. Aoki, Takashi, and Syuzo Egusa (Dept. of Fish., Fac. of Agric., Univ. of Tokyo, Tokyo, Japan). 1971. DRUG SENSITIVITY OF Aeromonas liquefaciens ISOLATED FROM FRESHWATER FISHES. Bull. Jap. Soc. sci. Fish., 37(3): 176-185. In English.

Two hundred and fifty strains of Aeromonas liquefaciens isolated from fishes and soft-shelled turtles were studied for their sensitivity to 9 sorts of chemotherapeutics using agar-plate dilution method. One hundred and ten of the 250 strains were additionally tested for sensitivity to 3 other drugs. Most of the strains tested were highly sensitive to chloramphenicol, chlortetracycline, tetracycline, relatively highly sensitive to nifurpirinol, sulfamonomethoxine, and sulfisoxazole and moderately sensitive to fradiomycin, furazolidone, nitrofurazone, streptomycin and kanamycin and resistant to aminobenzyl penicillin. Criteria for defining resistant strains to the drugs were tentatively determined. According to the criteria out of the 250 strains 28 were one-drug-resistant, 38 were two-drug-resistant, 4 were three-drug-resistant and 8 were four-drug-resistant. Tetracycline-sulfanilamide resistance was a characteristic resistance pattern of drug-resistant A. liquefaciens.

14838. Itazawa, Yasuo (Dept. of Fish., Fac. of Agric., Kyushu Univ., Hakozaki, Fukuoka, Japan). 1971. AN ESTIMATION OF THE MINIMUM LEVEL OF DISSOLVED OXYGEN IN WATER REQUIRED FOR NORMAL LIFE OF FISH. Bull. Jap. Soc. sci. Fish., 37(4): 273-276. In English.

It is important to estimate the minimum level of dissolved oxygen in water required for normal life (provisionally named "the critical level for normal life") of fish, for estimation of the carrying capacity of a fish pond or a fish farm and estimation of required volume of fresh water inflowing per unit of time. It was found that the minimum level of dissolved oxygen in water required for maintenance of the oxygen content of arterial blood at the normal level (provisionally named "the critical level for normal value of arterial oxygen") almost coincided with "the critical level for normal life" estimated from culture, in rainbow trout, carp and eel. Therefore, "the critical level for normal value of arterial oxygen" is considered to be usable as a convenient and reliable substitute for "the critical level for normal life".

14839. Nanba, Kenjo, Teiji Kariya, and Shozo Kobayashi (Dept. of Fish., Fac. of Agric., Tohoku Univ., Tsutsumidori Amemiya-1, Sendai, Japan). 1971. THE INFLUENCE OF BRANCHIAL RESECTION UPON RESPIRATION IN CARP. Bull. Jap. Soc. sci. Fish., 37(4): 277-283. In Japanese.

The present work was undertaken to determine the effect of partial branchial resection on respiration and survival in carp. Oxygen consumption rate, hemoglobin level, total blood cell number and blood lactate level were determined to diagnose the respiratory condition of the operated fish. Branchial resection was carried out by cutting off with scissors the gill filaments at their base on one to seven gill arches. The rate of resection was expressed as the number of operated gill arches per 8 (total number of the gill arches). Bleeding stopped in general within a few minutes after operation, though neither styptic treatment nor disinfections were applied to the wounds. Operated fish were placed in aquaria immediately after the operation. All of them lay down on the bottom of the aquaria for a while and thereafter most of the fish which failed to swim within 20 hours died. Fish where the resection rate was 7/8 at a time died within 24 hours without exception. Some of the fish, however, in which the 7 gill arches were resected at intervals of 10 days survived for about a month after the final operation. Hemoglobin levels and total blood cell number were reduced in the operated fish for several days after operation. The hemoglobin levels of fish that died immediately after the operation were less than 10% in Sahli value, while those of the survivors at 24 hours after operation were more than 16%. It is concluded, therefore, that the cause of death after operation is due to loss of blood. Half of the carp in which the gill filaments on 6 gill arches were removed survived but the ability to resist low oxygen tensions of the survivors were lower than that of the controls. It is concluded that fish which have gill filaments intact on three of the 8 gill arches manage to take up necessary amounts of oxygen for keeping their normal activities and also resist low oxygen conditions.

14840. Takashima, Fumio, Takashi Hibiya, Takeshi Watanabe, and Takeshi Hara (Okutama Branch, The Tokyo Metropolitan Fish. Exp. Sta., Okutama, Tokyo, Japan). 1971. ENDOCRINOLOGICAL STUDIES ON LIPID METABOLISM IN RAINBOW TROUT - I. DIFFERENCES IN LIPID CONTENT OF PLASMA, LIVER AND VISCERAL ADIPOSE TISSUE BETWEEN SEXUALLY IMMATURE AND MATURE FEMALES. Bull. Jap. Soc. sci. Fish., 37(4): 307-311. In English.

Lipids of the liver and the other visceral adipose tissue, as well as plasma of hatchery-reared rainbow trout in different states of ovarian development were compared. Total visceral lipid was decreasing in the maturing female, reduction of triglycerides being most prominent. The content of lipid, especially of triglycerides and free fatty acids in the liver and plasma of the maturing female was increasing. It was suggested from these findings that the stored lipid was moved into the liver, extruded into the blood, and then taken up by the growing oocytes.

14841. Kawai, Shin-ichiro, and Shizunori Ikeda (Dept. of Fish., Fac. of Agric., Kyoto Univ., Maizuru, Japan). 1971. STUDIES ON DIGESTIVE ENZYMES OF FISHES - I. CARBOHYDRASES IN DIGESTIVE ORGANS OF SEVERAL FISHES. Bull. Jap. Soc. sci. Fish., 37(4): 333-337. In English.

The activities of various kinds of carbohydrases in the digestive organs of several fishes were determined with Tauber-Kleiner's method modified by the authors. Adult carp showed marked maltase, amylase, and weak sucrase, lactase, melibiase, cellobiase and methyl-α-D-glucosidase activities in the intestine. The activities of maltase and amylase in adult carp intestine were highest in the distal part while that of sucrase was highest in the central part. The specific activities of maltase and amylase in young carp intestine were higher than those in adult carp. Young carp also showed the activities of weak trypsin-like enzyme and maltase in the pharynx, and fairly high activities of trypsin-like enzyme, maltase and amylase in the esophagus. Even carnivorous fish such as red sea bream and marine ayu showed considerable activities of maltase in their digestive tract.

14842. Seki, Nobuo (Lab. of Biochem., Fac. of Fish., Hokkaido Univ., Hakodate, Japan). 1971. STUDIES ON THE ORGANIC PHOSPHATES IN THE VISCERA OF AQUATIC ANIMALS - VII. POST-MORTEM DEGRADATION OF NUCLEOTIDES IN THE LIVER OF RAINBOW TROUT. Bull. Jap. Soc. sci. Fish., 37(4): 317-321. In Japanese.

Living rainbow trout, Salmo gairdnerii irideus, were decapitated and stored at an ambient temperature of 0°C. After various lengths of time the livers were homogenized in cold 0.6 N perchloric acid, and nucleotides, nucleosides and bases extracted were determined by anion-exchange chromatography. The details of the analytical procedures have been described previously. ATP and ADP decreased rapidly with the accumulation of AMP and IMP. Since the dephosphorylation of nucleotide monophosphates is slower than deamination, AMP and IMP levels were high at the beginning, but after 6 hours both nucleotides and inosine decreased with the accumulation of hypoxanthine and xanthine. These changes are characteristic in comparison with those in the dorsal and red lateral muscles which show the accumulation of IMP and inosine for a long time. The level of adenosine was low throughout the experimental period. From these results, it may be postulated that the main pathway of the breakdown of purine nucleotides in the liver proceeds via AMP, IMP (adenosine), inosine, hypoxanthine to xanthine. Nicotinamide-adenine dinucleotide was broken down to ADP-ribose and nicotinamide. The UDP-sugars, which predominate among uracil nucleotides, disappeared rapidly.

14843. Sano, Tokuo (Tokyo Univ. of Fish., 4-5-7-chome, Konan Minato-ku, Tokyo, Japan). 1971. STUDIES ON VIRAL DISEASES OF JAPANESE FISHES - I. INFECTIOUS PANCREATIC NECROSIS OF RAINBOW TROUT: FIRST ISOLATION FROM EPIZOOTICS IN JAPAN. Bull. Jap. Soc. sci. Fish., 37(6): 495-498. In English.

Virological examination of 4 lots of glycerinated specimens of rainbow trout fry with "unknown disease" in Japan showed IPN virus to be present in all lots. The isolated agents were most like Buhl and d'Honnincthun IPN virus.

14844. Tabata, Mitsuo, Hiroshi Niwa, and Tamotsu Tamura (Fish. Lab., Fac. of Agric., Nagoya Univ., Chikusa, Nagoya, Japan). 1971. ON A SLOW POTENTIAL FROM THE EPIPHYSIS CEREBRI OF FISHES. Bull. Jap. Soc. sci. Fish., 37(6): 487-490. In Japanese.

Negative, slow and graded potential was recorded from the pineal organ of two fishes, ayu, Plecoglossus altivelis, and rainbow trout, Salmo gairdneri irideus. Some characteristics of the potential were examined. The response to test light (20 lux) occurred, in succession to the momentary potential drop. This potential drop (7~ 26mV in ayu and 10~ 30mV in rainbow trout) was thought to be the membrane potential of the cell. In both fishes, response amplitude increased linearly with log intensity of light and reached the maximum amplitude at about 30 lux. In rainbow trout, the latency was maximum (380 msec) at 0.01 lux and minimum (50 msec) at 300 lux, (mean values of 4 fishes). It decreased linearly with log intensity of light. This slow potential seems to originate from a pineal photoreceptor cell, but further investigations are necessary for a definite conclusion.

14845. Sano, Tokuo (Tokyo Univ. of Fish., 4-5-7 Chome, Konan Minato-ku, Tokyo, Japan). 1971. STUDIES ON VIRAL DISEASES OF JAPANESE FISHES - II. INFECTIOUS PANCREATIC NECROSIS OF RAINBOW TROUT: PATHOGENICITY OF THE ISOLANTS. Bull. Jap. Soc. sci. Fish., 37(6): 499-503. In English.

The four isolated viruses revealed the same pathogenicity to rainbow trout fry as the spontaneous epizootic of "unknown disease". Serological tests and experimental infectivity trials with the newly isolated viruses clearly showed the "unknown disease" of Japanese rainbow trout to be Infectious Pancreatic Necrosis.

14846. Hayashi, Seiichi (Lab. Biochem., Fac. Fish., Univ. of Hokkaido, Hakodate, Hokkaido, Japan). 1971. BIOCHEMICAL STUDIES ON THE SKIN OF FISH - II. SEASONAL CHANGE OF PURINE CONTENT OF MASU SALMON FROM PARR TO SMOLT. Bull. Jap. Soc. sci. Fish., 37(6): 508-512. In English.

On a catadromous group of young Oncorhynchus masou the guanine and hypoxanthine in the skin were determined in different seasons. Guanine content was highest in August for one year fish and in March for two years fish being 31.16 and 33.15 μmol/g skin respectively. The silvery coloration was observed on sample fish in either end March or end April being 5.52 μmol/g skin for the latter, not corresponding to the amount of the guanine deposited in the skin.

14847. Seki, Nobuo (Lab. of Biochem., Fac. Fish., Hokkaido Univ., Hakodate, Japan). 1971. STUDIES ON THE ORGANIC PHOSPHATES IN THE VISCERA OF AQUATIC ANIMALS - VIII. DEGRADATION OF ADENOSINE 5'-MONOPHOSPHATE IN THE LIVER OF RAINBOW TROUT. Bull. Jap. Soc. sci. Fish., 37(4): 322-325. In Japanese.

It was shown that the 7,000xg supernatant fraction of 0.13 M KCl homogenates of the fish liver contained both AMP deaminase and adenosine deaminase activities. Both of these activities were separated from each other by Sephadex G-200 gel filtration. These results clearly indicate that there are two degradation pathways for AMP in the liver of rainbow trout: (1) AMP is first deaminated to IMP which is subsequently dephosphorylated to inosine, and (2) it is first dephosphorylated to adenosine which is subsequently deaminated to inosine. The activity of the AMP deaminase increased with the addition of ATP.

14848. Oguri, Mikio (Fish. Lab., Fac. Agric., Nagoya Univ., Nagoya, Japan). 1971. A HISTOLOGICAL STUDY ON THE ACTH CELLS IN THE PITUITARY GLANDS OF FRESHWATER TELEOSTS. Bull. Jap. Soc. sci. Fish., 37(7): 577-584. In English.

Histological observations were made on the affinity of ACTH cells for lead hematoxylin and also on the distribution of these cells in the pituitary glands, using the following 10 species of teleosts: rainbow trout, Ayu, goldfish, carp, loach, two species of catfishes, Japanese eel, Medaka and snake-head fish. The teleostean ACTH cells exhibited a wide variation in the affinity for lead hematoxylin and also in histological distribution.

14849. Nagai, Masanori, and Shizunori Ikeda (Dept. Fish., Fac. of Agric., Kyoto Univ., Maizuru, Japan). 1971. CARBOHYDRATE METABOLISM IN FISH - I. EFFECTS OF STARVATION AND DIETARY COMPOSITION ON THE BLOOD GLUCOSE LEVEL AND THE HEPATOPANCREATIC GLYCOGEN AND LIPID CONTENTS IN CARP. Bull. Jap. Soc. sci. Fish., 37(5): 404-409. In English.

Changes in the amount of glycogen and lipid in the hepatopancreas and of blood glucose of carp under starvation and by feeding the diets in different composition consisting of carbohydrate and protein were investigated as the first step to study the utilization form of energy in carp. Under starvation the consumption of lipid prior to glycogen in hepatopancreas and temporary increase of the blood glucose level were found at the same time. In breeding experiments, as the carbohydrate content in diet increased or protein decreased, glycogen in the hepatopancreas increased while lipid in the hepatopancreas and the blood glucose level decreased. From these results it was suggested that in carp unlike in mammals carbohydrate is hardly converted to lipid but that protein is principally converted to lipid; carbohydrate does not precede either protein or lipid as energy source, but a certain amount of it is necessary.

14850. Nagai, Masanori, and Shizunori Ikeda (Dept. Fish., Fac. of Agric., Kyoto Univ., Maizuru, Japan). 1971. CARBOHYDRATE METABOLISM IN FISH - II. EFFECT OF DIETARY COMPOSITION ON METABOLISM OF GLUCOSE-6-^{14}C IN CARP. Bull. Jap. Soc. sci. Fish., 37(5): 410-414. In English.

In order to confirm that carbohydrate would not be a primary requirement for energy source in carp, from a view point of intermediate metabolism of glucose, incorporation of glucose-6-^{14}C into glycogen and blood glucose, its excretion to $^{14}CO_2$ and randomization of ^{14}C in glucose molecule in carp which were fed the various diets consisting of carbohydrate and protein were investigated. Glucose-6-^{14}C was scarcely incorporated into glycogen in all groups but oxidized to $^{14}CO_2$. When more than 50% of protein was contained in diet, oxidation of glucose-6-^{14}C decreased remarkably, and at the same time blood glucose pool and the extent of randomization of ^{14}C in glucose were increased. From these observations it was suggested that carp possesses the active and reversible Embden-Meyerhof pathway but that glycogen is not a principal storage depot of energy.

14851. Ooshiro, Zentaro (Fac. Fish., Kagoshima Univ., Shimoaratacho, Kagoshima, Japan). 1971. STUDIES ON PROTEINASE IN THE PYLORIC CAECA OF FISHES - III. SUBSTRATE SPECIFICITY OF MACKEREL PROTEINASE. Bull. Jap. Soc. sci. Fish., 37(7): 638-641. In Japanese.

The substrate specificity of mackerel proteinase has been investigated with the use of many synthetic substrates. Mackerel proteinase hydrolysed the following substrates: Nα-benzoyl-L-argininine-amide, chloracetyl-L-leucine, acetyl-DL-methionine and chloracetyl-DL-methionine, while it did not hydrolyse the following substrates: carbobenzoxy-L-glutamyl-L-tyrosine, acetyl-L-tyrosine-amide, Nα-benzoyl-L-tyrosineamide and ϵ-benzoyl-α-acetyl-DL-lysine. These results show that the proteinase has very broad specificity. Effects of various metals on the activity of this enzyme were examined. No effect was brought forth by di-valent metal ions. Experiments with N-acylated derivatives of amino acid, such as methionine and leucine, indicated that the proteinase has an optical specificity, i.e. it hydrolyses the L-isomer, but not the D-isomer. It may be of interest that this enzyme can be used for the optical resolution of acylated DL-amino acids.

14852. Roberts, R. J. (Dept. Vet. Pathol., Univ. of Glasgow, Bearsden, Glasgow, England). 1971. U.D.N. - THE PRESENT STATE OF OUR KNOWLEDGE. Riv. It. Piscic. Ittiop., 6(3): 63-64.

Elucidation of the disease known as UDN appears to be a much more complex problem than was at first thought. It is an infectious disease, is not of bacterial origin and would not appear to be associated with a skin virus. The skin lesions may well be atrophic ulcers of neural origin or direct products of the stress from an as yet unidentified lesion elsewhere, since at the time of developing sexual maturity the skin of salmonids is subject to considerable hormonal stress even in

the normal fishes (e.g. spawning ulcers in male rainbow trout (S. gairdnerii)). The disease does not appear to be of much significance as far as the future of the Atlantic salmon is concerned as no measurable decrease in smolt runs has been found in affected rivers since the outbreak of the disease. In view of our inability to find an aetiological agent, meaningful certification would anyway be impossible.

14853. Ghittino, P., and S. Dalforno (Istituto Zooprofilattico Sperimentale del Piemonte e Liguria, Centro Studo Malattie Pesci., Via Bologna, 148 - 10154 Torino, Italy). 1971. SPONTANEOUS NEPHROBLASTOMA IN A HATCHERY RAINBOW TROUT (Salmo gairdneri). Riv. It. Piscic. Ittiop., 6(3): 69-72. In Italian with English summ.

The authors describe a nephroblastoma incidentally found in the posterior kidney of a female rainbow trout (Salmo gairdneri) sampled in an Italian trout farm. This fish weighed 3 kg and was 3-4 years old (roughly). Histopathological characteristics of the tumor are similar to those previously found by other authors in the same fish-species during experimental trials of oncology, after feeding trout with a diet containing dimethylnitrosamine. The authors did not find metaplasia and metastases, in contrast to previous experience with nephroblastoma described in humans and other vertebrates and also in the fish (Morone saxatilis). They conclude that no etiological suggestions are available to elucidate the onset of the tumor in this trout. Basing upon a preliminary and incomplete survey, the incidence of nephroblastoma appeared very low, if one considers that 35 trout-spawners were later examined in the same trout farm with negative findings.

14854. Imura, Koji (Lab. of Biochem., Fac. of Fish., Hokkaido Univ., Hakodate, Japan). 1971. STUDIES ON ALKALINE RNA-HYDROLYZING ENZYME IN THE PYLORIC CAECA OF RAINBOW TROUT. Bull. Jap. Soc. sci. Fish., 37(8): 735-739. In Japanese.

Though a large number of nucleases have been investigated, little is known about the enzymes in fish. The present investigation was undertaken to elucidate the property and function of the nucleases in fish. As a first step in this program, the RNA-hydrolyzing enzyme in the pyloric caeca of rainbow trout was studied. The frozen pyloric caeca was homogenized in 10 volumes of 0.25 M sucrose solution, and the homogenate was filtered through a gauze. The filtrate was used as the enzyme solution. The enzyme activity was estimated from readings obtained for absorbance at 260 mμ of the acid soluble degradates from RNA. In the pyloric caeca of rainbow trout, two kinds of RNA-hydrolyzing activities were observed. One of the activities was observed at the acidic pH (pH optimum 5.5) and the other at the alkaline pH (pH optimum 8.75). In this report, some properties of the alkaline RNA-hydrolyzing enzyme are described. The activity level of the enzyme is similar to that of the enzyme found in rat pancreas. This enzyme is very labile, but in the presence of Ca^{++}, the enzyme gets stabilized specifically to pH and heat. The enzyme is characterized by its marked stabilization with Ca^{++}

14855. Kawai, Akira, and Isao Sugahara (The Res. Inst. for Food Science, Kyoto Univ., Kyoto, Japan). 1971. MICROBIOLOGICAL STUDIES ON NITROGEN FIXATION IN AQUATIC ENVIRONMENTS - I. ON THE DISTRIBUTION OF NITROGEN FIXING BACTERIA IN FRESH WATER REGIONS. Bull. Jap. Soc. sci. Fish., 37(8): 740-746. In English.

In aquatic environments, nitrogen fixation is one of the most important processes in the nitrogen cycle, because the process is responsible for the recovery of nitrogen loss caused by denitrification and the productivity of a water region is sometimes restricted by the nitrogen budget of the region. In the first step of the study, the authors have intended to obtain information about the distribution of nitrogen fixing bacteria in various water regions, the M.P.N. method with the liquid media containing sucrose and non-nitrogenous compound being used for enumeration of the bacteria. This paper is concerned primarily with the occurrence and abundance of nitrogen fixing bacteria in some fresh water regions. In Lake Biwa and Lake Yunoko, the number of the bacteria was somewhat small in the water i.e. 10^{-1}-10^{2} cells/ml, while, 10^{2}-10^{4} cells per 1 g of the bacteria were detected in the bottom sediments of the lakes.

14856. Kawai, Akira, and Isao Sugahara (The Res. Inst. for Food Sci., Kyoto Univ., Kyoto, Japan). 1971. MICROBIOLOGICAL STUDIES ON NITROGEN FIXATION IN AQUATIC ENVIRONMENTS - II. ON THE DISTRIBUTION OF NITROGEN FIXING BACTERIA IN SEA WATER REGIONS. Bull. Jap. Soc. sci. Fish., 37(8): 747-754. In English.

By the use of the method reported in the previous paper, the distribution of nitrogen fixing bacteria was studied in some sea water regions. The standing crop of the bacteria in the water was 10^{-1}-10^{2} cells/mL in inland bays such as Maizuru Bay and Kumihama Bay in Kyoto Prefecture, while the number was quite small in offshore waters in Suruga Bay and Sagami Bay, i.e. 0-800 cells/L. In the water of East China Sea, the open sea, the standing crop of the nitrogen fixing bacteria was as small as 0-400 cells/L, which were detected mostly in the surface water above 100 m, and the bacterial number decreased rapidly with the depth below around 100 m.

14857. Yonezawa, Katsuyuki, and Tamotsu Tamura (Fish. Lab., Fac. Agric., Nagoya Univ., Nagoya, Japan). 1971. FLICKER-ERG IN THREE SPECIES OF FISHES, RAINBOW TROUT, FUNA AND EEL. Bull. Jap. Soc. sci. Fish., 37(9): 846-850. In Japanese.

Instead of the critical fusion frequency (cff) of the flicker-ERG, the frequency at which the amplitude becomes half the maximum amplitude (FHMA) was adopted to investigate the ability to perceive moving objects in the three species of fishes. Effects of light intensity and temperature upon the FHMA were studied. The FHMA of the light-adapted eyes of the fishes vary not only with light intensity, but also with temperature. In rainbow trout, when the temperature was raised and reached 23～25°C, the FHMA decreased. These high temperatures seem to deteriorate the eye function. The FHMA changed linearly as a function of light intensity. In a given temperature and light intensity, the FHMA is highest in rainbow trout, lowest in eel and intermediate in goldfish. This conclusion harmonizes well with the visual habits of the fishes and with the sizes of their optic tectums.

14858. Kawai, Akira, Motohiko Sugiyama, and Isao Sugahara (The Res. Inst. for Food Sci., Kyoto Univ., Kyoto, Japan). 1971. MICROBIOLOGICAL STUDIES ON NITROGEN FIXATION IN AQUATIC ENVIRONMENTS - IV. ON THE NITROGEN FIXING BACTERIA IN CULTURE PONDS. Bull. Jap. Soc. sci. Fish., 37(10): 986-991. In English.

In the previous papers, the authors have reported the distribution of nitrogen fixing bacteria in natural water environments. This paper concerns the occurrence of the bacteria in fish culture ponds, in which the concentration of nutritional salts is extremely high, in addition to the large population of total heterotrophic bacteria, i.e. 10^{4}-10^{7} cells/g in the bottom sediments. Even in such eutrophic water regions, the standing crop of nitrogen fixing bacteria was not larger than that in the other water environments, namely 0.1-10 cells in 1 mL of the water. A diurnal change in the number of the bacteria was not observed in spite of the considerable fluctuation of the physical environment in these ponds. In the bottom sediments of the culture ponds, the bacterial standing crop was 10^{2}-10^{3} cells/g, which was comparable with that in natural eutrophic ponds.

14859. Ooshiro, Zentaro (Fac. of Fish., Kagoshima Univ., Shimoaratacho, Kagoshima, Japan). 1971. STUDIES ON PROTEINASE IN THE PYLORIC CAECA OF FISHES - IV. KINETIC STUDIES ON THE HYDROLYSIS REACTION OF Nα-BENZOYL-L-ARGININEAMIDE CATALYZED BY MACKEREL PROTEINASE. Bull. Jap. Soc. sci. Fish., 37(11): 1110-1114. In Japanese.

Kinetic studies have been made on the hydrolytic reactions of synthetic peptide catalyzed by purified mackerel proteinase. The kinetic constant, the apparent Michaelis constant K_m and the apparent maximal velocity V_{max}, were determined for the hydrolysis of Nα-benzoyl-L-arginineamide. It is important to note that the factors which influence the velocity of enzyme reactions may be produced by either one of the following: by an effect on the formation, or an effect on the breakdown, of the enzyme-substrate complex. The Michaelis constant K_m and the

maximal velocity V_{max} were found to be 0.79×10^{-3} M and 27.7 M per mole of enzyme per min. respectively, at pH 9.0 and 35°C. The activation energy for the mackerel proteinase is calculated to be 6.5 K cal. Judging from the results of kinetic analysis, it was proposed that, combined with substrate in the activated complex, a sort of ES-complex is readily formed by the mackerel proteinase.

14860. Lindahl, P. E., and E. Schwanbom (Inst. of Zoophysiol., Uppsala, Sweden). 1971. ROTATORY-FLOW TECHNIQUE AS A MEANS OF DETECTING SUBLETHAL POISONING IN FISH POPULATIONS. Oikos, 22(3): 354-357.

The rotatory-flow technique has been applied to roach Leuciscus rutilus L. from the mercury-contaminated Lake Ovre Hillen and from Lake Snosjon, which, as it chiefly receives spring-water, is supposed to contain water that is comparatively pure. A highly significant difference in the mean critical rate of rotation (in r.p.m.) was found between the two samples of fish which also differed but in a reverse way with respect to the amount of methylmercury hydroxide found in their muscles. For the combined samples of fish, the critical rate of rotation showed a highly significant negative correlation to the amount of mercurial per unit muscle. The appearance of the same relationship for the fish from Lake Snosjon indicates that also in "pure" natural waters the coordination of a proportion of the fish is significantly decreased by the presence of methylmercury hydroxide in their bodies. (Authors)

14861. Jernelöv, Arne, and Hans Lann (Swedish Water and Air Pollution Res. Lab., Stockholm, Sweden). 1971. MERCURY ACCUMULATION IN FOOD CHAINS. Oikos, 22(3): 403-406.

The relation between methyl mercury concentrations in the liver and in muscle of fish indicates the relation between accumulation and excretion rates of methyl mercury. The total mercury content of benthic animals is of little interest when one calculates the rate of mercury transport from benthic animals to fish that feed on them. This is because the percentage of methyl mercury in the total mercury content of the benthos is generally low (much lower than the percentage in fish) and the total mercury content is very variable. The methyl mercury transportation from benthic fauna to bottom feeding fish is evidently small. By comparing the total mercury content of the three ecological subtroups of benthic animals, it seems possible to separate situations where release of mercury prevails from situations where it has ceased. (Authors)

14862. Wolf, Ken, and Robert W. Darlington (Eastern Fish Dis. Lab., Kearneysville, West Virginia). 1971. CHANNEL CATFISH VIRUS: A NEW HERPESVIRUS OF ICTALURID FISH. Journal of Virology, 8(4): 525-533.

Channel catfish virus was studied in ictalurid fish cell culture, the only system of fish, amphibian, avian, and mammalian cells found to be susceptible. Channel catfish virus infection resulted in intranuclear inclusions and extensive syncytium formation. Replication occurred from 10 to 33 C, but not higher. Best growth was from 25 to 33 C, and the amount of virus released nearly equalled the amount which remained cell-associated. The virus was labile to lipid solvents, and indirect determinations with labeled precursors and a metabolic inhibitor showed evidence of deoxyribonucleic acid. Electron microscopy showed progeny virus, about 100 nm in diameter, in various stages of development in cell nuclei by 4 hr. Present also were nuclear masses of exceptionally electron-dense lamellar material, with a unit dimension of 10 to 15 nm. Virus was enveloped at the nuclear membrane and in cytoplasmic vacuoles, resulting in virions having a diameter of 175 to 200 nm. Negative staining demonstrated icosehedral symmetry and 162 capsomeres. Our data indicate that channel catfish virus is a herpesvirus. (Authors)

14863. Shcherbina, M. A., and O. P. Kazlauskene [All-Union Pond Fish. Res. Inst. (VNIIPRKH), Rybnoye Postal District, Moscow Province, USSR]. 1971. A STUDY OF THE DIGESTIBILITY OF ARTIFICIAL FOODS BY POND FISHES COMMUNICATION IV. DIGESTIBILITY OF THE NUTRIENTS OF SUNFLOWER OIL-SEED MEAL, LUPIN, RYE AND FOOD MIXTURE BY YEARLING CARP. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 253-257.

14864. Menshutkin, V. V. (Inst. of Evol. Physiol. and Biochem., USSR Acad. of Sciences, USSR). 1971. THE MODELING OF THE INTERACTION BETWEEN A FISHERY AND THE ECOLOGICAL SYSTEM OF A BODY OF WATER. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 158-163.

A functional model of the ecological system of a lake has been created and realized on a computer. An investigation is made of the effect on the ecoysstem of alteration in the regime of fishing for predatory and nonpredatory fishes, and the nature of the effect on the fish catch of external stimuli on the ecosystem (meteorological conditions above the surface of the body of water, supply of allochthonous matter) is also established. It is shown that there is real possibility of examining problems of the fish productivity of bodies of water on a model by the use of computer techniques.

14865. Makeyeva, A. P., and B. V. Verigin (Dept. of Ichthyology, Moscow State Univ., Moscow, USSR). 1971. USE OF THE METHOD OF PITUITARY INJECTIONS IN THE PROPAGATION OF SILVER CARP AND GRASS CARP. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 174-185.

An analysis is made of the results of research in Soviet Central Asia in the period 1966-1969. Data are given concerning pituitary dose rates, the correlation between pituitary doses, the size of the fishes, the degree of maturity of the gonads and temperature condition throughout the spawning season, on the one hand, and the working fecundity, the percentage of females yielding eggs, and the survival of the eggs, on the other hand. A number of questions are raised concerning terminology.

14866. Kuznetsov, V. A. (Dept. of Vertebrate Zool., Kazan State Univ., USSR). 1971. THE EFFECT OF REGULATION OF THE DISCHARGE OF THE VOLGA ON THE REPRODUCTION OF ASP, ZOPE, WHITE BREAM AND BLEAK IN SVIYAGA BAY, KUYBYSHEV RESERVOIR. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 186-192.

The alteration of the hydrologic regime of the Middle Volga as a result of construction of the Kuybyshev Power Station has had some effect on the reproduction of fishes. The asp has adapted itself to new spawning grounds and substrates. It lays its eggs on the stony bottom, on plants and exposed roots in the bank zone and the flooded zone. The bleak spawns in the shallows and in open flooded areas. The zope breeds only in bank areas where there is profuse aquatic vegetation, and when water level fluctuates during the spawning period its eggs perish. The white bream lays its eggs in the shallow-water zone. Because there is repeated addition of water at this time, the effectiveness of its reproduction is relatively high.

14867. Turdakov, A. F. (Inst. of Biol., Kirgiz Acad. of Sciences, Frunze, USSR). 1971. THE EFFECT OF TEMPERATURE CONDITIONS ON THE SPEED AND FERTILIZING CAPACITY OF THE SPERMATOZOA OF SOME ISSYK-KUL' FISHES. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 206-215.

The basic parameters of the movement of the spermatozoa of the Issyk-Kul' trout, "osman" and "chebachok" were determined in fresh water at different temperatures. Within certain temperature limits the relationship between environmental temperature, on the one hand, and the duration of movement, maximum speed and rate of decline in speed when the spermatozoa move with negative acceleration, on the other hand, is logarithmic in nature. Real differences are observed in the sensitivity of spermatozoa to rise in temperature, and these differences are apparently due to the different degree of thermophily of the species investigated. It has been established that the fertilizing capacity of "chebachok" spermatozoa correlates with their motility only within a certain temperature range, outside which this correlation is infringed as a result of intensive destruction of the tail filaments of the spermatozoa.

14868. Uyeno, Teruya, and G. R. Smith (Mus. of Zool., Univ. of Mich., Ann Arbor, Michigan). 1972. TETRAPLOID ORIGIN OF THE KARYOTYPE OF CATOSTOMID FISHES. Science, 175(4022): 644-646.

Catostomid fishes appear to have $2n(\rightarrow 4n?) \simeq 100$ chromosomes. The

Cyprinidae, from which catostomids probably diverged before the Eocene, usually have 2n = 48 or 50 chromosomes. Preliminary cytophotometric measurements indicate an approximate doubling of DNA content of cells among catostomids. (Authors)

14869. Hurlbert, Stuart H., Joy Zedler, and Deborah Fairbanks (Dept. of Biol., San Diego State Coll., San Diego, California). 1972. ECOSYSTEM ALTERATION BY MOSQUITOFISH (Gambusia affinis) PREDATION. Science, 175(4022): 639-641.

In artificial pools Gambusia affinis greatly reduced rotifer, crustacean, and insect populations and thus permitted extraordinary development of phytoplankton populations (2×10^8 cells per milliliter). Other effects included decreased optical transmissivity and increased temperature of the water, decreased amounts of dissolved inorganic phosphorus, and increased amounts of dissolved organic phosphorus, inhibition of Spirogyra, and replacement of one annelid, Chaetogaster, by another, Aeolosoma. (Authors)

14870. Shumilov, I. P. (Limnol. Inst., Siberian Dept., USSR Acad. of Sciences, Listvennichnoye, Irkutsk Province, USSR). 1971. SURVIVAL OF EGGS OF THE BAIKAL OMUL [Coregonus autumnalis migratorius (Georgi)] IN SPAWNING GROUNDS OF THE KICHERA RIVER AND THE EFFECT OF RIVER FLOW ON THE STRENGTH OF YEAR-CLASSES. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 223-230.

An account is given of the results of studies of survival of the eggs of the North Baikalian population of the omul in spawning grounds of the Kichera River in 1968-1969. The effect of abiotic and biotic environmental factors on egg mortality during the period of embryonic development is revealed. Consideration is given to the effect of the level of the river during the breeding period of the omul and during the downstream migration of the larvae on formation of the strength of the year-classes. Recommendations are made concerning an increase in the effectiveness of reproduction of the omul.

14871. Korniyenko, G. S. (Krasnodar Branch, All-Union Pond Fish. Res. Inst., (VNIIPRKh), Krasnodar, USSR). 1971. THE ROLE OF INFUSORIA IN THE FOOD OF THE LARVAE OF PHYTOPHAGOUS FISHES. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 241-246.

Silver carp, Hypothalmichthys molitrix, bighead Aristichthys nobilis and grass carp Ctenopharyngodon idella larvae feed on Infusoria in the first stages of development. The highest consumption of Infusoria is noted in silver carp larvae in development stages I and II. The lowest consumption of Infusoria averaged over the day is noted in grass carp larvae. Consumption of Infusoria declines sharply when the fishes transfer to their specific diet of phyto-zooplankton and macrophytes.

14872. Yarzhombek, A. A., and N. V. Maslennikova (All Union Res. Inst. for Sea Fish. and Oceanogr. (VNIRO), Moscow, USSR). 1971. NITROGENOUS METABOLITES OF THE EGGS AND LARVAE OF VARIOUS FISHES. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 276-281.

The composition of the nitrogenous metabolites of sea trout and rainbow trout eggs, of beluga and spiny sturgeon eggs and larvae, and also of thornback ray eggs is qualitatively the same. Ammonia, urea and a number of amino acids were discovered. The dynamics of the excretion of nitrogenous metabolites by eggs differ greatly in salmonids (taking the sea trout as an example) and sturgeons (taking the beluga as an example), but in neither case is it possible to relate the quantity of nitrogenous metabolites to the general metabolic rate. It is assumed that the excretion of nitrogenous substances by eggs is connected with ensuring the turgor of the chorion. (Conclusions)

14873. Konchin, V. V. (Dept. of Ichthyology, Moscow State Univ., Moscow, USSR). 1971. THE USE OF ROTATING CLOSED VESSELS TO DETERMINE THE RATE OF OXYGEN CONSUMPTION BY FISH EGGS. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 286-288.

A method of closed rotating respirators is proposed in the present article for

determination of the rate of oxygen consumption by fish eggs. The features of the installation are simplicity of manufacture, reliability in operation and practicability for use under field conditions.

14874. Girsa, I. I. (A. N. Severtsov Inst. of Evol. Morphol. and Animal Ecology, USSR Acad. of Sci., Moscow, USSR). 1971. ORIENTATION OF THE YOUNG OF SOME FRESHWATER FISHES IN A PHOTOBAROGRADIENT CHAMBER. Journal of Ichthyology, published by Amer. Fish. Soc., 11(2): 288-292.

An examination was made under vertical photogradient conditions of the case in which young fishes attracted by a light overcome a pressure gradient varying (increasing or decreasing) within the limits of the levels encountered under natural conditions when young are distributed in the inshore areas of a body of water. The experiments were conducted with exposure to one stimulus (only varying pressure with uniform illumination and in darkness) and with simultaneous exposure to two stimuli (varying illumination and pressure). Light was an orienting and attracting factor for the experimental young and also a dominant stimulus. Under these experimental conditions pressure did not affect the vertical distribution of the fishes (irrespective of the presence of a dominant stimulus).

14875. Zillich, John A. (Mich. Dept. of Nat. Res., Water Resources Comm., Michigan). 1972. TOXICITY OF COMBINED CHLORINE RESIDUALS TO FRESHWATER FISH. J. Wat. Poll. Contr. Fed., 44(2): 212-220.

On-site continuous flow bioassays on fathead minnows using chlorinated and dechlorinated effluents from two treatment plants have shown residual chlorine to be the principal toxic agent in these effluents. The toxic effects at both locations were similar, in spite of the fact that one plant received metal-finishing wastes and the other did not; in both cases, the pH and dissolved oxygen concentration were favorable for fish life. The residual chlorine concentrations that produced a 100 percent kill were 0.16 and 0.21 mg/l; threshold concentrations were 0.04 and 0.05 mg/l. The addition of sodium thiosulfate to both effluents removed the residual chlorine and rendered them nontoxic.

14876. Wallace, Dale C. (Dept. of Biol., Eastern Mich. Univ., Ypsilanti, Michigan). 1971. THE ECOLOGY OF THE SILVERJAW MINNOW, Ericymba buccata Cope. Amer. Midl. Natur., 87(1): 172-190.

A study of the ecology of the silverjaw minnow, Ericymba buccata Cope, in Otter Creek, Vigo Co., Indiana, was based on random samples taken over a period of 1 year. This method enabled analysis of temporal and spatial changes in the occurrence of this species with respect to the environmental factors measured. Comparisons between the ecology of Ericymba buccata and Pimephales notatus (Rafinesque) were drawn. Ericymba was the most abundant species in this relatively small, soft-bottomed stream. It usually occurred in non-wooded areas, over sand or sand-and-fine-gravel bottoms, in situations between 6 inches and 2.5 ft deep, and 16 to 40 ft wide with current speeds less than 1.5 fps. Certain aspects of its physiology and behavior are adaptive to these conditions. Although commonly associated with Pimephales notatus, the next most abundant species, the occurrence of the silverjaw minnow was less narrowly defined with regard to depth and flow. Pimephales occurred at significantly higher densities in "slow flow-deep" areas than in "moderate flow-shallow" areas. In contrast, the silverjaw minnow occurred at essentially the same densities in both of these situations and at much higher densities than the bluntnose minnow in the "moderate flow-shallow" areas. Although Ericymba has a high tolerance to turbidity and mine wastes, its numbers are reduced where turbidity and mine wastes have deposited silt layers over otherwise habitable stream bottoms. This species apparently moves into somewhat deeper water in the winter and remains there during early spring. Based on densitiies of occurrence it appears that young-of-the-year tend to move downstream in the autumn and remain there as yearlings until sometime the following autumn when they move upstream. (Auth.)

14877. Mathur, Dilip (Ichthyological Associates, Box 12, Drumore, Pennsylvania). 1972. SEASONAL FOOD HABITS OF ADULT WHITE CRAPPIE, Pomoxis annularis Rafinesque, IN CONOMINGO RESERVOIR. Amer. Midl. Natur., 87(1): 236-241.

Stomach contents of 903 adult white crappie (160 to 310 mm fork length) collected from June 1966 to December 1967 in Conowingo Reservoir were analyzed. By volume, zooplankton and small fishes were dominant food items in most of the spring, summer and autumn months, whereas amphipods predominated in the winter months. Insects and plant material were least important in the diet. Based on percentage frequency of occurrence, amphipods were found most frequently in the stomachs throughout the year. Dipterans (midge larvae and pupae) ranked next in importance. Zooplankters (Cyclops and Daphnia), sunfishes (Lepomis spp.) and johnny darter (Etheostoma olmstedi) appeared most frequently in the spring, summer and autumn months. The wide variety of organisms in the diet suggested opportunistic feeding habits. Feeding activity was heaviest in June through October, moderate in April, May and November, and lowest in the winter months. (Auth.)

14878. Lighthill, M. J., F.R.S. (Dept. of Applied Math. and Theoretical Physics, Silver Street, Cambridge, England). 1971. LARGE-AMPLITUDE ELONGATED-BODY THEORY OF FISH LOCOMOTION. Proc. R. Soc. Lond. B., 179(1055): 125-138.

The elongated-body theory of the reactive forces on a fish moving in water (that is, forces resulting from the inertia of associated water movements) is extended so that a prediction of instantaneous reactive force between fish and water is obtained for fish motions of arbitrary amplitude, regular or irregular. A preliminary application of the theory to the balance of reactive thrust and resistive drag in regular carangiform swimming of fishes with slender caudal fins is made. Comparison with data on the dace Leuciscus suggests that an important feature of this balance may be a substantial enhancement of drag for such fishes when swimming movements commence, an enhancement here interpreted in terms of a boundary-layer-thinning mechanism first suggested by Dr. Quentin Bone. (Auth.)

14879. Roberts, B. L., and K. P. Ryan (The Lab. of the Mar. Biol. Assoc., Plymouth, England). 1971. THE FINE STRUCTURE OF THE LATERAL-LINE SENSE ORGANS OF DOGFISH. Proc. R. Soc. Lond. B., 179(1055): 157-169.

The sense organs of the body lateral-line canals of Scyliorhinus were examined with the electron microscope and shown to consist of supporting cells and two kinds of sensory cell. One type of sensory cell has the well-known structure of hair cells, bearing on its apical surface a group of stereocilia (6 to 25) associated with a single kinocilium. Each hair cell is innervated by a sensory nerve fibre and some also receive an efferent nerve supply. The second kind of sensory cell is similar in appearance, but differs at the apex in containing many vacuoles and in lacking stereocilia. There are many long microvilli and a single cilium which arises from a shallow pit. The internal structure of this cilium is variable, with the number of tubules in the outer ring ranging between 7 and 9 and with the inner pair consisting of double elements. This type of sensory cell is innervated by sensory nerve fibres and possibly by efferent fibres. The situation of the kinocilium of a hair cell in relation to the stereocilia is more variable than has been described in other hair cells while the cilium of the second sensory cell appears to bear no special relation to the microvilli. The accessory cells of the neuromast include basal and peripheral supporting cells, many of which produce a secretion, and a large secretory cell which is found at intervals at the edge of the organ. This cell has a convoluted surface and is full of vesicles. (Authors)

14880. Jensen, A. L. (Environ. Biol. Branch, Div. of Environ. Res. and Development, Tenn. Valley Auth., Muscle Shoals, Alabama). 1972. STANDARD ERROR OF LC_{50} AND SAMPLE SIZE IN FISH BIOASSAYS. Water Research, 6(1): 85-89.

The relationship between the relative error and sample size in fish bioassays was investigated empirically and theoretically. It was shown that if the mean concentration tested is near the estimated LC_{50} and the same sample size is used at each test level, the dependence of relative error on sample size is predictable. Increasing the sample size significantly reduces the standard error of the estimated LC_{50} until the sample size reaches about 30 fish. (Auth.)

14881. Burton, Dennis T., and Andrea M. Spehar (Dept. of Biol., Va. Polytech. Inst. and State University, Blacksburg, Virginia). 1971. A RE-EVALUATION OF THE ANAEROBIC ENDPRODUCTS OF FRESH-WATER FISH EXPOSED TO ENVIRONMENTAL HYPOXIA. Comp. Biochem. Physiol., 40(4A): 945-954.

Lactic acid and free short-chain fatty acids have been reported in the literature as anaerobic endproducts produced by fish when exposed to environmental hypoxia. A significant increase in lactic acid was found in skeletal muscle and liver of Salmo trutta exposed to sudden hypoxia and of Salmo gairdneri, Lepomis macrochirus and Ictalurus nebulosus exposed to gradual hypoxia. No free short-chain fatty acids were found in skeletal muscle or liver of control or experimental fish after being exposed to hypoxia. A significant reduction in pyruvic acid was found in skeletal muscle only of Salmo gairdneri and Lepomis macrochirus after being exposed to gradual hypoxia. No changes in the types of anaerobic endproducts occurred as a result of thermal acclimation to warm and cold temperatures. (Authors)

14882. Olson, K. R., and P. O. Fromm (Dept. of Physiol., Mich. State Univ., East Lansing, Michigan). 1971. EXCRETION OF UREA BY TWO TELEOSTS EXPOSED TO DIFFERENT CONCENTRATIONS OF AMBIENT AMMONIA. Comp. Biochem. Physiol., 40(4A): 999-1007.

When rainbow trout were subjected to increased ambient ammonia they excreted decreased amounts of ammonia nitrogen and total waste nitrogen. Ammonia-N, urea-N and protein-N accounted for an average of 94 percent of total nitrogen excreted by trout. Except for a slight increase in urea excretion at very low ambient ammonia levels the rate of urea and protein excretion by trout remained constant throughout the range of ammonia levels tested. Trout acclimated to 5 μg ammonia/ml showed no increase in urea excretion above that of fish acclimated to 0.5 μg/ml. Goldfish subjected to increased ambient ammonia levels showed an increase in urea excretion rates. The rate of urea excretion by goldfish was dependent on the 24-hr experimental ammonia levels but was not affected by the concentration of ambient ammonia during acclimation or the duration of acclimation. (Authors)

14883. Mayerle, Joan A., and David G. Butler (Ramsay Wright Zool. Labs., Univ. of Toronto, Toronto, Canada). 1971. EFFECTS OF TEMPERATURE AND FEEDING ON INTERMEDIARY METABOLISM IN NORTH AMERICAN EELS (Anguilla rostrata LeSueur). Comp. Biochem. Physiol., 40(4A): 1087-1095.

When the temperature of acclimation for starved eels was raised from 5-15°C, blood glucose and muscle glycogen decreased whereas blood and muscle lactate and muscle pyruvate increased. At the higher temperature serum glutamic-oxaloacetic transaminase (SGOT) activity decreased and plasma protein increased. Lipolysis increased during starvation but plasma FFA and blood glycerol were the same at both 5 and 15°C. Feeding decreased tissue FFA and glycerol but had no measurable effect on SGOT or plasma protein concentrations. . Glucose remained at the starvation level but liver and muscle glycogen increased, suggesting that at 15°C glucose was converted to glycogen and was also rapidly oxidized to meet the needs for increased metabolic activity. (Authors)

14884. Heath, Alan G. (Va. Polytech. Inst. and State Univ., Blacksburg, Virginia). 1972. A CRITICAL COMPARISON OF METHODS FOR MEASURING FISH RESPIRATORY MOVEMENTS. Water Research, 6(1): 1-7.

Six different methods for detecting and measuring fish respiratory movements are reviewed and compared. Several yield only breathing frequency which may not reflect alterations in the ambient water. The matter of disturbance to the fish by certain methods is discussed. The method giving the most information appears to be the measurement of buccal and opercular pressures with indwelling catheters and sensitive pressure transducers. Where simplicity is important, breathing frequency may be obtained from the recording of the changing potentials between two external electrodes not actually attached to the fish. (Auth.)

14885. Massaro, Edward J. (Dept. of Biochem., State Univ. of N. Y. at Buffalo, Buffalo, New York). 1972. ISOZYME PATTERNS OF COREGONINE FISHES: EVIDENCE FOR MULTIPLE CISTRONS FOR LACTATE AND MALATE DEHYDROGENASES AND ACHROMATIC BANDS IN THE TISSUES OF Prosobium cylindraceum (Pallas) AND P. coulteri (Eigenmann and Eigenmann). J. Exp. Zool., 179(2): 246-262.

Starch gel electrophoresis reveals the presence of 22 LDH isozymes in the round whitefish (Prosobium cylindraceum). Immunoprecipitation and molecular hybridization experiments demonstrate that the genome of this species codes for ten types of LDH subunits designated A, A', B, B', D, D', E, E', F, and F'. These subunits comprise the parental homotetramers of five distinct groups of isozymes designated a, b, d, e, and f. The group f isozymes are found exclusively in skeletal muscle and the e group isozymes are found exclusively in the eye. The a, b, d, and e group isozymes are immunologically related. The group f isozymes do not cross-react with antibodies prepared against either the A_4 or B_4 homotetramers of weakfish, Cynoscion regalis. Six types of LDH subunits, designated B, B', D, D', E, and E', are coded for by the genome of the pygmy whitefish (P. coulteri). They comprise the parental homotetramers of three distinct, but immunologically related, groups of isozymes designated b, d, and e. As in the rainbow trout (Salmo gairdneri), no in vivo intergroup molecular hybridization of LDH isozymes has been observed nor can it be induced in vitro in either P. cylindraceum or P. coulteri. The isozymes of analogous groups from P. cylindraceum, P. coulteri, and S. gairdneri can be hybridized in vitro. Two distinct MDH phenotypes were observed in P. cylindraceum; a simpler (S) pattern composed of four isozymes and a more complex (C) pattern composed of six-seven isozymes. A pattern of six-seven MDH isozymes similar to the C pattern of P. cylindraceum is found in P. coulteri. The ovarian LDH and MDH isozymes of P. cylindraceum are unique in that they migrate more slowly toward the anode than analogous isozymes in other tissues. The achromatic bands which are observed on starch gels stained for LDH or MDH activity are described. (Auth.)

14886. Whitt, Gregory S., Paula L. Cho, and William F. Childers (Dept. of Zool., Univ. of Ill., Urbana, Illinois). 1972. PREFERENTIAL INHIBITION OF ALLELIC ISOZYME SYNTHESIS IN AN INTERSPECIFIC SUNFISH HYBRID. J. Exp. Zool., 179(2): 271-282.

Interspecific hybrids were produced in the laboratory by crossing male redear sunfish (Lepomis microlophus) with female warmouth (Lepomis gulosus). Approximately three-fourths of the F_1 hybrids were morphologically normal, whereas the remainder possessed a deformity of the lower jaw. This deformity may have been due to a failure of nucleocytoplasmic interactions during development. The reciprocal cross of male warmouth x female redear was subject to complete mortality at the free-swimming stage. Enzymes, the parental allelic isozymes of which are electrophoretically distinguishable, were chosen as genetic markers. Both of the parentally derived allelic isozymes for malate dehydrogenase and tetrazolium oxidase were synthesized in the adult F_1 hybrid. Heteropolymers containing both types of subunits were formed for these two enzymes. Thus, both parental alleles were functional in the hybrid. An esterase isozyme observed only in the redear was absent in the adult F_1 hybrid. This result suggests that the synthesis of this paternal isozyme may have been repressed because the egg cytoplasm was incompatible with the paternally derived allele. Maternal allelic repression was apparently observed at the lactate dehydrogenase E locus. The warmouth E locus functioned in the heart tissue so that the two heteropolymers B_3E_1 and A_3E_1 were synthesized, but these two heteropolymers were not detected in the redear cardiac tissue or in the heart tissue of the adult F_1 hybrid. These results suggest the repression of this maternally derived gene function in the F_1 hybrid. The morphologically normal and abnormal F_1 hybrids possessed identical isozyme patterns for all four enzyme systems. (Authors)

14887. Stalling, David L., and James N. Huckins (Fish-Pesticide Research Lab., Bur Sport Fish. & Wildl., Columbia, Missouri). 1971. GAS-LIQUID CHROMATOGRAPHY - MASS SPECTROMETRY CHARACTERIZATION OF POLYCHLORINATED BIPHENYLS (AROCLORS) AND ^{36}CL-LABELING OF AROCLORS 1248 AND 1254. J. Assoc. Official Analytical Chemists, Vol. 54, pp. 801-807.

The isomer composition of the Aroclor 1200 series was characterized by GLC-MS, using temperature programming and SE-30 support-coated, open-tubular capillary columns. A method is described for the preparation and purification of ^{36}Cl-labeled Aroclors 1248 and 1254. Neutron irradiation of the commercial material was used to prepare the ^{36}Cl-labeled material. Purification of the irradiated product was accomplished by silicic acid column chromatography. Yields of the purified product were between 63 and 99%, with no detectable alteration of the isomer composition; 10% of the ^{36}Cl produced was associated with the unchanged PCB isomers and the remaining radioactivity was contained in polychlorinated terphenyls. The terphenyls were produced by irradiation polymerization, and they were easily separated from the PCB components. Mass spectrometry, utilizing either temperature programmed GLC or direct probe sample introduction, was used to characterize the irradiation products. The radioactive materials are being utilized in experiments to determine uptake and metabolism of PCB by aquatic organisms. (Authors)

14888. Lumare, F., and P. Villani (Direttore del Laboratorio per lo Sfruttamento Biologico delle Lagune - CNR - 71010 Lesina, Italy). 1971. PRELIMINARY EXPERIMENTS OF INDUCED SPAWNING ON THE GILTHEAD (Sparus auratus). Riv. It. Piscic. Ittiop., 6(4): 95-97. In Italian with English summary.

The authors report the techniques used in the induction of artificial fertilization in Sparus auratus. The experiment was carried out on a lot of 8 fish. They were injected with human chorionic gonadotropin (HCG) at the end of an acclimatization period in laboratory tanks. The hormonal extract amounts increased progressively till sexual maturity; at this stage the fishes released their sexual products. Afterwards it was possible to realize their dry fertilization. In this experiment the authors used only two females; in the first case the hatching rate was 56%, in the second about 10%. The eggs were floating by a large oil globule; they hatched about 46 hours after fertilization at the average temperature of 18°C. The larva, a few hours old, was very transparent and just slightly pigmented; its length was 2.0 mm. Experiments are now in progress on the development and feeding of the larvae.

14889. Ghittino, P., and S. Maletto (Centro per lo Studio delle Malattie dei Pesci, Istituto Zooprofilattico Sperimentale del Piemonte e della Liguria, Via Bologna, 148 - 10154 Torino, Italy). 1971. RESIDUE DETERMINATION OF METRIFONAT IN FISH AND WATERS AFTER THERAPEUTIC TREATMENT WITH MASOTEN. Riv. It. Piscic. Ittiop., 6(4): 99-104. In Italian with English summary.

After a short bibliographic review concerning the use of Masoten for the control of external Parasitosis in fish, the authors report about the methods and results of the Metrifonat-residue-determination in fish and water after treatment with this compound. The researches were carried out on several fish species (Salmo gairdneri, Anguilla anguilla, Leuciscus cephalus cabeda, Tinca tinca), exposed to 0.25-0.30 ppm of Masoten, in fish-ponds, laboratory tanks or frozen at -5°C. Samples were taken at different times after treatment (24 hours - 30 days) and analyzed through gas chromatography for Metrifonat-residues. The data obtained was considered to be statistically significant. In treated fish and water a net decrease of Metrifonat-residue was encountered within 30 days (in fish from 0.0053 - 0.0061 to 0.0006 - 0.0008 ppm; in water from 0.23 - 0.25 to 0.04 - 0.03 ppm; in frozen fish after storage at -5°C from 0.0073 - 0.0082 to 0.0022 - 0.0026 ppm). The decomposition of the compound takes place even in natural lakes and is accelerated concomitantly with temperature increase. The authors reached the conclusion that Masoten is suitable to be legally employed in large scale control of harmful external parasitic disease in fish at fish farms, as this compound is efficient at low concentrations, harmless for fish and of very speedy decomposition in water.

14890. Saksena, Vishnu P., and Edwin B. Joseph (Muskingum College, New Concord, Ohio). 1972. DISSOLVED OXYGEN REQUIREMENTS OF NEWLY-HATCHED LARVAE OF THE STRIPED BLENNY (Chasmodes bosquianus), THE NAKED GOBY (Gobiosoma bosci), AND THE SKILLETFISH (Gobiesox strumosus). Contribution No. 408, Va. Inst. of Mar. Sci.; Chesapeake Science, 13(1): 23-28.

Newly-hatched larvae of the striped blenny (Chasmodes bosquianus), the naked goby (Gobiosoma bosci), and the skilletfish (Gobiesox strumosus) were exposed for 24 hours to varying concentrations of dissolved oxygen obtained by purging York River water with pre-purified grade nitrogen. The experimental apparatus is described. The striped blennies and the naked gobies had median tolerance limits (TL_{50}), the oxygen concentrations at which 50% of the larvae would be expected to die after 24 hours, of 2.50 mg/l (0.95 C.L.: 2.05 $\leq TL_{50} \leq$ 3.05) and 1.30 mg/l (0.95 C.L.:1.09 $\leq TL_{50} \leq$ 1.54) respectively. The TL_{50} was not calculated for the skilletfish but apparently lies between 0.72 mg/l and 1.23 mg/l. (Authors)

14891. Morgan, Raymond P. II, Ted S. Y. Koo, and George E. Krantz (Nat. Res. Inst., Univ. of Maryland, Chesapeake Biol. Lab., Solomons, Maryland). 1972. ALBUMIN POLYMORPHISM IN THE WHITE PERCH, Morone americana. Contribution No. 475 of the Nat. Res. Inst., Univ. of Md.; Chesapeake Science, 13(1): 66-68.

Albumin polymorphism has been detected by electrophoresis in acrylamide gels in the white perch, Morone americana. Three phenotypes were present: Alb AA, a fast migrating albumin; Alb BB, a slow migrating albumin; and Alb AB, a combination of the two. The distribution of these three phenotypes was analyzed in a small sample of white perch from the Patuxent River Estuary, Maryland. The observed phenotypic distribution was not significantly different from the expected, indicating possible control by two alleles of a single gene. This polymorphism could be used for studying populations and population genetics of the white perch along the Atlantic Coast. (Authors)

14892. Stickney, Robert R., and James W. Andrews (Skidaway Inst. of Oceanog., Savannah, Georgia). 1971. COMBINED EFFECTS OF DIETARY LIPIDS AND ENVIRONMENTAL TEMPERATURE ON GROWTH, METABOLISM AND BODY COMPOSITION OF CHANNEL CATFISH (Ictalurus punctatus). J. Nutrition, 101(12): 1703-1710; Comm. Fish. Abstr., 25(4): 18, 1972.

A study of the interaction of five environmental temperatures (20, 24, 26, 30, and 33°), and three types of dietary lipids (beef tallow, safflower oil, and menhaden oil) on the growth and body composition of channel catfish, Ictalurus punctatus, indicated that maximum growth was obtained at 30° for fish fed each lipid supplement for a 70-day experimental period. At all temperatures, higher gains were obtained from beef tallow and menhaden oil than safflower oil supplements; likewise, lower food conversion rates were obtained from beef tallow and menhaden oil. The lipid level in fish carcasses increased with increasing temperatures up to 30° for all dietary supplements. At the optimum temperature for growth (30°), fish fed beef tallow contained less lipid than those fed the other supplements. The fatty acid composition of the diets was reflected in both liver and carcass lipids. (Authors)

14893. Andrews, James W. (Skidaway Inst. of Oceanog., Savannah, Georgia). 1972. STOCKING DENSITY AND WATER REQUIREMENTS FOR HIGH-DENSITY CULTURE OF CHANNEL CATFISH IN TANKS OR RACEWAYS. Feedstuffs, 44(6): 40-41; Comm. Fish. Abstr., 25(4): 23, 1972.

Channel catfish can be reared at densities of up to 8 lb. per cu. ft. of water (1 lb. of fish per gal. of water). During a 200-day experimental period, there was a gain of over 11 lb. per cu. ft. of water. Extrapolation of this growth rate curve data to a full 365-day growing period would give a production of over 20 lb. per cu. ft. of water. The food conversion ratio for the catfish was 1.6 (lb. gain per lb. feed). The author concludes that high density culture of catfish in tanks or raceways may be economical provided ideal environmental conditions and water temperatures can be maintained at low cost.

14894. Davis, Robert M. (Univ. of Maryland, Nat. Resources Inst., La Vale, Maryland). 1972. AGE, GROWTH, AND FECUNDITY OF THE ROSYSIDE DACE, Clinostomus funduloides Girard. Contribution No. 474 of the Nat. Res. Inst., Univ. of Maryland; Chesapeake Science, 13(1): 63-66.

Information on growth rate, age composition, and fecundity of rosyside dace was obtained from a sample of 212 fish collected from April to August 1970 from the North Branch of Jennings Run, Potomac River drainage. Total lengths ranged from 46 to 94 mm and average weights ranged from 1.4 g (40-49 mm length class) to 10.4 g (90-99 mm length class). Ages of rosyside dace included age groups I to IV. Sexual maturity was attained at about 53 mm and age I for both sexes. The spawning season lasted from early May until late June. The mean diameter of eggs during the spawning season ranged from 1.05 mm in May to 1.20 mm in June. Fecundity ranged from 139 (56-59 mm length class) to 802 (90-95 mm length class). There was a high correlation between fecundity and length and weight of dace, but a low correlation between fecundity and age and weight of ovaries. (Auth.)

14895. Fenderson, Owen C., and M. Ralph Carpenter (Dept. of Inland Fish. and Game, Bangor, Maine). 1971. EFFECTS OF CROWDING ON THE BEHAVIOUR OF JUVENILE HATCHERY AND WILD LANDLOCKED ATLANTIC SALMON (Salmo salar L.). Anim. Behav., 19(3): 439-447.

In aquaria, wild juvenile Atlantic salmon (Salmo salar L.) were most aggressive at low population densities and hatchery salmon at intermediate or high densities, indicating differences in social development of fish reared in streams where population densities are regulated by territorial dispersion and in hatcheries where fish are confined at abnormally high densities. Social interaction interfered with feeding, resulting in hatchery salmon consuming less food than wild salmon as density was increased. Both hatchery and wild salmon became more aggressive, consumed more food, were more stationary, and exhibited less escape swimming with time. Caution should be exercised when making inferences about norms of behaviour characteristics of the species in general when either hatchery or wild fish are used as experimental subjects. (Authors)

14896. Sutterlin, A., N. Sutterlin, and S. Rand (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. THE INFLUENCE OF SYNTHETIC SURFACTANTS ON THE FUNCTIONAL PROPERTIES OF THE OLFACTORY EPITHELIUM OF ATLANTIC SALMON. Fish. Res. Bd. Canada Tech. Report No. 287, 8 p. plus tables.

Over 150 synthetic surfactants were tested for stimulatory effectiveness and possible blocking effects on the sensory discharge evoked by amino acids in the olfactory epithelium of Atlantic salmon parr. Few surfactants were stimulatory at 1 and 10 ppm and no trends were apparent relating stimulatory effectiveness to certain classes of these compounds. Blocking effects at 1 ppm and lower were observed for several alkylbenzenesulfonates, quaternary ammonium and imidazolinium salts and diamines. Most blocking effects were reversible following rinsing with clean water. Nonionic surfactants exhibited no blocking effects. (Authors)

14897. Tuunainen, Pekka (Hydrobiol. Res. Inst., Jyväskylä, Finland). 1970. RELATIONS BETWEEN THE BENTHIC FAUNA AND TWO SPECIES OF TROUT IN SOME SMALL FINNISH LAKES TREATED WITH ROTENONE. Annales Zoologici Fennici, 7(1): 67-120.

The influence of some physical, chemical and biotic factors upon the growth and survival of brown trout (Salmo trutta L.) and rainbow trout (S. gairdneri Richardson) introduced into nine small lakes in southern and central Finland is described. The lakes had been treated with rotenone before being stocked with trout. Attention was especially paid to the interrelations between the fish and the benthic fauna, the selective feeding of the fish, and the biological productivity of the benthic fauna and fish populations. In most respects the lakes were found to be suitable habitats for trout. Scarcity of food and the small size of the food organisms were the most important factors limiting the growth of the fish. The fish stock had a considerable influence upon the abundance of the benthic fauna. Clear selective feeding was observed; animals living on submerged vegetation as well as freely in water were preferred to benthic organisms. Factors affecting the productivity of the benthic fauna and fish stock are discussed in detail. (Auth.)

14898. Ludke, J. Larry, James R. Gibson, and Christina I. Lusk (Dept. of Zool., Miss. State Univ., State College, Mississippi). 1972. MIXED FUNCTION OXIDASE ACTIVITY IN FRESHWATER FISHES: ALDRIN EPOXIDATION AND PARATHION ACTIVATION. Toxicology and Applied Pharmacology, 21(1): 89-97.

Experiments are described which demonstrate that freshwater fishes possess mixed function oxidase (MFO) enzymes which catalyze the epoxidation of aldrin and the activation of parathion in vivo. These reactions apparently occur in the liver as evidenced by rapid aldrin accumulation in the liver followed by simultaneous aldrin decrease and dieldrin increase. MFO inhibitors, sesamex and SKF 525A, antagonized both parathion activation and toxicity, but antagonized only the epoxidation of aldrin. A mutual antagonism between parathion and aldrin is shown in which simultaneous treatment reduced the metabolism of both compounds. The action of sesamex is clearly in liver as evidenced by inhibition of in vitro activation of parathion. These results suggest that MFO systems in freshwater fishes may be a rule rather than an exception and that previous failures to demonstrate in vitro epoxidation of aldrin may be the result of inadequate methodology. Our findings also substantiate observations that aldrin epoxidation is not necessarily an activation. (Authors)

14899. Dill, Lawrence M. (Inst. of Anim. Resource Ecol., Univ. of Br. Columbia, Vancouver, British Columbia, Canada). 1972. VISUAL MECHANISM DETERMINING FLIGHT DISTANCE IN ZEBRA DANIOS (Brachydanio rerio Pisces). Nature New Biology, 236(62): 30-32.

The purpose of the research briefly described here was to determine if a mathematical formulation could be developed to describe the reactive distance of prey as a function of the size and velocity of an approaching predator. The relationship $D = \sqrt{\frac{VS}{K} - \frac{S^2}{4}}$ has proved useful in predicting the flight distance of zebra danios to a real predator, the largemouth bass (Micropterus salmoides). Further studies have provided evidence that the value of K may be modified through experience of a particular predator. The threshold value decreases, and hence reactive distance increases, asymptotically with increasing experience. The model assumes that the prey are capable of monitoring either $d\alpha/dt$ or, more likely, the rate of change of image size on the retina.

14900. Peakall, David B., and Raymond J. Lovett (Section of Ecol. and Systematics, Cornell Univ., Ithaca, New York). 1972. MERCURY: ITS OCCURRENCE AND EFFECTS IN THE ECOSYSTEM. BioScience, 22(1): 20-25.

Preliminary reports indicate that levels in marine fish have not increased in recent years. The levels found in tuna and swordfish are likely natural levels caused by their predatory nature and longevity. This conclusion is in line with the fact that the amount released annually by man is about 10^4 tons compared to 10^8 tons present in the ocean. Thus, without some subtle concentrating mechanisms, man's activities cannot appreciably alter the levels in the total ocean. Since appreciable levels of the synthetic compound DDE have been found in pelagic animals, the possibility of concentrating mechanisms cannot be entirely ignored. The annual input of DDT to the environment is $1\text{-}2 \times 10^5$ tons. The direct human health hazard of environmental mercury appears to be limited to those persons for whom fish is a dominant part of their diet. The concentration of mercury in the aquatic food-chain combined with transformation into methyl mercury are the causative factors in this problem. The finding of increased chromosome breakage associated with elevated levels of blood in persons eating fish regularly (levels in fish were probably 1-7 ppm) and concentration across the placenta suggests that the currently accepted level of 0.5 ppm does not have an appreciable margin of safety for pregnant women. For wildlife the hazard appears to be appreciable to two groups. The first are the seed-eaters feeding directly on seeds pretreated with mercurials. The second are birds at the top of the fresh-water food chain. Although the genetic risks remain to be fully elucidated, there is sufficient evidence to indicate that it exists. It should be possible to reduce greatly the faction of man's usage that is allowed to escape into the freshwater or land environment and this should be undertaken immediately. The problem of the addition via the combustion of fossil fuel will be more difficult to tackle. (Authors summ.)

14901. Heland, M. (Laboratoire d'Éthologie, Faculté des Sciences, 35 - Rennes, France). 1971. INFLUENCE OF THE INITIAL POPULATION DENSITY UPON THE CONQUEST OF NEW TERRITORIES BY THE BROWN TROUT Salmo trutta L. IN ARTIFICIAL BROOK. Ann. Hydrobiol., 2(1): 25-32. In French.

In three identical experimental streams (I, II and III), 100, 50 and 25 brown trout have been introduced, at yolk sac resorption. One month later, the numbers of fry are the following: 37 (I), 27 (II) and 14 (III); on the other hand, territories are not significantly different in number. Moreover, for every stream, daily observations show a regression in the number of trout in statical swimming, which is faster as the initial density is heavier. At the end of the experiment, the numbers of trout in statical swimming tend towards the same value for each stream. The slightly lower growth of the "I" batch of trout can be explained by their higher level of aggressiveness, too much food being distributed into the three streams. This spatial competition, which leads to very close densities of trout owning their territory for a given substratum, for any initial density, is observed from the first days following yolk sac resorption. (Auth. summ.)

14902. Micha, J.-C. (Inst. de Zool. de l'Université, Quai Van Beneden 22, B - 4000 Liège, Belgique). 1971. POPULATION DENSITY, AGE AND GROWTH OF BARBEL Barbus barbus (L.) AND GRAYLING Thymallus thymallus (L.) IN THE OURTHE RIVER. Ann. Hydrobiol., 2(1): 47-68. In French.

Estimation of fish populations by the two catch effort method is very successful for Barbel Barbus barbus (L.) but the mark-recapture method is inefficient. For Grayling Thymallus thymallus (L.) the catch effort and the mark-recapture method are not good. Age and growth study in Barbel shows that these fish grow more quickly in the Danube than in the Ourthe River. Length-weight relationship studies show three age groups. The first two groups have allometric growth and the third age group, with the oldest individuals, has isometric growth. By comparing age and growth in Grayling in the Ourthe River and in other European waters, we see that growth in the Ourthe is quicker than in the Scandinavian Svartbacken, and slower than in the Welsh Llyn Tegid. Coefficient calculation in length-weight relationship shows two age groups with allometric growth. (Auth. summ.)

14903. Heland, M. (Laboratoire d'Éthologie, Faculté des Sciences, 35-Rennes, France). 1971. OBSERVATIONS ON THE FIRST STAGES OF THE AGONISTIC AND TERRITORIAL BEHAVIOUR OF THE BROWN TROUT Salmo trutta L. IN ARTIFICIAL BROOK. Ann. Hydrobiol., 2(1): 33-46. In French.

This work deals with the activities of trout fry, leading them to settle in a territory after yolk sac resorption. This study was carried out in laboratory conditions, in an experimental stream supplied with recirculated water; the bottom of this stream was made of different substrata. The incubation method was different for the two trout batches used successively. Daily observations on trout activities and locations were taken and a test for territory attachment was carried out every three days. The settlement of trout in a territory takes place in several phases: the first one, which corresponds to an unsteady period, shows a uniform distribution of trout which keep interindividual distances. The second phase, which is a transient period occurring at the same time as the establishment of a hierarchy, corresponds to a stabilization of trout on the substratum they hold; during the third phase, which corresponds to a steady period, the territorial pattern is worked out, and a slow elimination of lower organisms then begins for the benefit of the more dominating organisms which thus enlarge their territory during their growth. Along with territorial stabilization comes the formation of a hierarchy joined to the outbreak of a series of fixed agonistic behaviors. One is thus confronted with a territorial and hierarchical society, composed of dominating trout, owners of a territory, and of dominated trout compelled to hide themselves under stones. (Auth. summ.)

14904. Cuinat, R. (Sta. d'Hydrobiologie, I.N.R.A., B.P. 79, 64-Biarritz, France). 1971. ECOLOGICAL DIAGNOSES IN FOUR TROUT STREAMS IN NORMANDY. Ann. Hydrobiol., 2(1): 69-134. In French.

Ecological diagnoses were worked out at end of summer, in 1961 and 1962, in 8 areas of 4 trout streams of Seine-Maritime, 1.5 to 10 m wide, the studied areas being 125 to 360 m long. On most of these areas, the riparian owners have exclusive fishing rights, according to custom in North-West of France. For each area, results are given by means of diagrams and include a comprehensive diagnosis with management advices. All these rivers, affected by an oceanic climate, have a very low slope (below 3 p. 1 000), cold water very rich in calcium (over 100 mg/l), and contain a very large phanerogamic vegetation. Aquatic invertebrates are very abundant (about 150 cm^3 per m^2), mainly gammarids. On the whole, trout populations, Salmo trutta L., of these streams have the following characteristics (the values given below are average): - density: high to very high (5000 trout, i.e. 250 kg. per ha); - individual growth: very quick (31 cm, total length, reached in 3 years); - reproduction potential: generally very high (14 eggs per m^2); - age structures varying according to private or public fishing, with a frequent lack of 0^+ trout; - high annual net production (260 kg/ha); "theoretically exploitable net production" (relating to trout longer than 18 cm) is 162 kg/ha; - low exploitation (except in public areas): about 16 percent of theoretically exploitable net production; - migrations generally not very important among trout older than one year, which do not show any clear tendency to move from underexploited areas to neighbouring overfished areas. Survival from plantings during this research period appears generally as poor. Three of these streams have also strong eel population, Anguilla anguilla L., (maximum: 1300 kg, average: 366 kg per ha). The presence of sculpin, Cottus gobio L., corresponds with the best balanced trout population. All species together, the stock is very large (maximum 1700 kg average: 635 kg per ha). Among management advices valuable for all studied areas, the most important are: - to fight against slime, essentially by destruction of unnecessary dams; - to catch as many eels as possible; - to intensify definitely trout captures in private areas; the present legal size of 23 cm, however, does not need to be lowered; - in all underexploited areas, any planting is needless. Wisely managed and exploited, it is probable that these streams could give to fishing at least 100 kg trout per hectare and per year, that is 4 times more than now, on an average; then this would enable to classify them among the most productive in France. (Auth. summ.)

14905. Bond, H. W., and G. C. Fuller (Water Resources Center, R. I. Univ., Kingston, Rhode Island). 1971. CORRELATION OF STRUCTURE VERSUS ACTIVITY OF POLLUTANTS OF FRESH WATER. Completion Report, R. I. Water Res. Center, Kingston, 11 p., available from the National Tech. Information Service as PB-205 606, $3.00 in paper copy, $0.95 microfiche; Selected Water Resources Abstracts, 5(6): 52, 1972.

The toxicity of many classes of compounds in snails (and probably in many other aquatic animals as well) is due to the ability of these compounds to inhibit oxygen uptake, by interaction with enzymes which require intact-SH (i.e. Sulfhydryl) groups for normal function. Among the classes of compounds highly toxic to snails which are potent sulfhydryl inhibitors are B-nitrostyrenes, Vinyl ketones, vinyl sulfones, zinc dithiocarbamates, and quaternary salts. The sulfhydryl reactivity of representative B-nitrostyrenes and vinyl sulfones was determined by observing the change produced by the color-forming reaction between cysteine and 5, 5 (1)-dithiobis (2-nitrobenzoic acid) in the presence and in the absence of the sulfhydryl reactive agent. There is a direct correlation, for the compounds studied between their toxicity to snails and their ability to inhibit sulfhydryl groups. This suggests that similar correlations likely exist for other compounds whose toxicity to snails is due to their ability to inhibit sulfhydryl groups.

14906. Cairns, John, Jr., Timothy K. Bahns, Dennis T. Burton, Kenneth L. Dickson, Richard E. Sparks, and William T. Waller (Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1972. THE EFFECTS OF pH, SOLUBILITY AND TEMPERATURE UPON THE ACUTE TOXICITY OF ZINC TO THE BLUEGILL SUNFISH (Lepomis macrochirus Raf.) Trans. Kans. Acad. Sci., 74(1): 81-92.

Bluegill sunfish (Lepomis macrochirus Rafinesque) were exposed for 96 hours under static test conditions to water soluble $ZnSO_4 \cdot 7H_2O$ and water insoluble $Zn_3(PO_4)_2 \cdot 4H_2O$ at two temperature ranges (21-24°C; 7-9°C) and two pH ranges (5.7-7.0; 7.3-8.8). Control fish were maintained in water containing no zinc. No bluegills died in water containing insoluble zinc in amounts comparable to the amounts of soluble zinc (13.50, 18.00, 24.00, and 32.00 mg Zn^{++}/l) which produced mortalities of 90 to 100%. Bluegill mortalities in concentrations of soluble zinc ranging from 10 to 32 mg Zn^{++}/l were 0 to 10% at the high pH, while at the low pH mortalities were 100%. Bluegills at the low temperatures died at a much slower rate, and the time-to-death of the first fish was considerably delayed, in comparison to bluegills at the warmer temperature. Continuous flow bioassay tests in which two types of test containers were used showed differences in 96-hour TL_m values. The particle replacement time in 19-liter bioassay jars was considerably longer than in 1.4-liter plexiglass containers, hence bluegills survived longer in the jars. Ninety-six-hour TL_m concentrations for fish exposed to a continuous flow of Zn^{++} in two types of test containers were estimated in four ways: using statistically pooled measured and calculated concentrations, and by pooling calculated and measured concentrations on the basis of the nominal concentrations alone. There were small differences in the resulting TL_m values, a result which should be of interest to other workers using bioassays. (Authors)

14907. Elliott, J. M., and T. B. Bagenal (Freshwater Biol. Sta., Ambleside, England). 1972. THE EFFECTS OF ELECTROFISHING ON THE INVERTEBRATES OF A LAKE DISTRICT STREAM. Oecologia, 9(1): 1-11.

The experiments were performed in Dale Park Beck, a stony stream in the English Lake District. Two operators electrofished the sampling area (length 20 m in April and July, 1970, and 40 m in May 1971) three times (runs 1, 2, 3) in each experiment. Electrofishing caused a marked increase in the number of invertebrates drifting out of the sampling area, and nearly all taxa taken in the bottom samples were also found in the drift samples. The fish shocker was chiefly responsible for the increased drifting of Plecoptera, Ephemeroptera and Gammarus pulex, and these taxa were dislodged from the substratum more easily than Trichoptera, Coleoptera, Diptera and Polycelis felina. The increased drifting of the latter taxa was chiefly due to the disturbance of the substratum by the two operators. Most of the invertebrates drifting from the upstream end of the experimental section returned to the bottom within the sampling area. The invertebrate drift out of the sampling area came chiefly from the downstream end of the section, and was equivalent to a loss of only 5% from the total benthos in the sampling area (losses varied between <1 and 13% for individual taxa). (Authors summ.)

14908. Pennsylvania State University (Dept. of Biol., Univ. Park, Pennsylvania). 1971. HISTOCHEMICAL AND CYTOPHOTOMETRIC ASSAY OF ACID STRESS IN FRESHWATER FISH. Water Pollution Control Research Series, Environmental Protection Agency, Grant No. DXJ 18050, 113 p.

The feasibility of using histochemical and histopathological changes in brook trout, longnose dace and fathead minnows as bioindicators of acid pollution was investigated. Laboratory studies entailed using a gravity flow diluter system. Field studies involved using net traps in polluted streams. Exposure durations were 4-5 days and 28-30 days. Histochemical and cytophotometric analyses were made of gills, Stannius corpuscle, blood, spleen, kidney and liver. The primary mode of acid toxicant action is gill damage which results in impaired respiratory, excretory and liver functions. Short term indices of acid stress include: colloidal iron and PAS staining of gills and renal Stannius corpuscles. A useful bioindicator of prolonged acid exposure is decreased azure B-RNA staining of liver

cells; this assesses the extent of liver impairment and reflects a reduced tolerance of fish to other toxicants. Sublethal levels of acidity are not cumulative. However, pH levels of about 5.0 should be considered hazardous since they prove toxic to breeding fish having increased oxygen needs and also reduce the liver's ability to detoxify noxious substances present in acid polluted waters.

14909. The State Fish and Game Departments, The National Conservation Organizations, and the Bureau of Sport Fisheries and Wildlife, U. S. Department of the Interior. 1971. ACTION REPORT. CONSERVATION AND ENHANCEMENT OF FISH AND WILDLIFE IN THE NATIONAL WATER RESOURCES PROGRAM. U. S. Dept. of the Interior, Bur. Sport Fish. & Wildlife, 50 p.

This report contains 169 recommendations for action. There are recommendations for amended and new legislation, Federal and State. There are recommendations for new and improved policies by Federal and State agencies and private conservation organizations. There are recommendations for new procedures and new methods of financing. These recommendations came from 238 people from all parts of the Nation, representing the State fish and wildlife agencies, the National conservation organizations, and the Bureau of Sport Fisheries and Wildlife. The time has come finally to fulfill the promise of the 1958 amendments to the Fish and Wildlife Coordination Act that fish and wildlife shall receive equal consideration with all other features of water resources projects. It is time for Federal and State fish and wildlife agencies to depart from their unsatisfactory role of reactors to the initiatives of the water resources agencies. It is time for them to take a full hand in planning for our Nation's water and related land resources from the very beginning on every proposed project. (From Foreword)

14910. Rass, T. S., and G. U. Lindberg (Inst. of Oceanogr., USSR Acad. of Sciences, Leningrad, USSR). 1971. MODERN CONCEPTS OF THE CLASSIFICATION OF LIVING FISHES. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 302-319.

The system of living fishes is based on the major exposition and revision of earlier concepts published by L. S. Berg in 1940 - 1955 with additions and corrections from the most important new research. Two classes of living fishes are distinguished by dividing into subclasses, superorders, orders and families. In descriptions of the superorders and orders of the class Chondrichthyes, data on body structure and the most recent information on the structure of the teeth have been taken into consideration. In the descriptions of taxa of the class Osteichthyes use has been made mainly of data on the position and structure of the fins, on the position of the excretory orifices, on the structure of the body covering and the most important internal organs, and also on ontogeny. An outline of the system (principal taxa) and a key to the main characters of the class Osteichthyes are given as appendices to the article.

14911. Gorodnichiy, A. Ye. (Azov Fish. Res. Inst. (AzNIIRKh), Rostov-on-Don, USSR). 1971. THE MAIN FACTORS AFFECTING THE ABUNDANCE OF VALUABLE SEMI-MIGRATORY FISHES OF THE DON. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 376-381.

There is a definite correlation between run-off from the land and the abundance of fish year-classes. A high run-off yields high abundance of year-classes not only in the years when it occurs, but also in the next few years of little water. Run-off from the land has an influence not only on the effectiveness of spawning, but also on the survival conditions of fish in the sea, which are dependent on the extent of freshening of the water. In connection with the increase in the salinity of the Sea of Azov after the regulation of river discharge there was a sharp reduction in the ranges of semi-migratory fishes and their environmental conditions deteriorated, as is shown by the reduction in their growth, condition and abundance. A salinity of 6-10 $^{o}/_{oo}$ is suitable for these fishes.

14912. Khalturin, D. K. (White Sea Biol. Sta., Zool. Inst., USSR Acad. of Sciences, USSR). 1971. BIOLOGICAL CONSIDERATIONS RELATING TO COMMERCIAL SIZE FOR THE BROWN TROUT [Salmo trutta morpha lacustris (L.)] IN THE GREAT LAKES OF NORTHERN KARELIA. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 370-375.

Commercial size is one of the determining factors of the regime and effectiveness of fishing. The technique and intensity of fishing and the level of biological knowledge have altered, but the commercial size for many species of particularly valuable fishes remains the same for a number of decades. It is not surprising that reduction is then noted in stocks of brown trout. Data characterizing local populations of brown trout permit a critical evaluation of the situation which has arisen and of a reexamination of the requirements set out for the exploitation of fish stocks with the object of a stable increase in the productivity of bodies of water. The development of a system of biological requirements for fishing is a general problem of fish management, and the present statement of the basis for commercial size goes beyond the limits of a narrow problem in its content, is solved in relation to basic aspects of the reproduction of brown trout and may therefore be regarded on the whole as a standard solution. Only this type of formulation of the problem guarantees that the desired result is obtained.

14913. Avedikova, T. M. (Azov Res. Inst. for Sea Fish. and Oceanogr. (AzNIIRKh), Rostov-on-Don, USSR). 1971. THE EFFECT OF ENVIRONMENTAL FACTORS ON THE DISTRIBUTION OF UNDERYEARLING PIKE-PERCH [Lucioperca lucioperca (L.)] AND AZOV ROACH [Rutilus rutilus heckeli (Nordm.)] IN DIFFERENT AREAS OF THE SEA OF AZOV. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 387-396.

An analysis is made of the main factors affecting the distribution of underyearlings: salinity and available food resources. A correlation is established between the feeding capacity of the areas and the distribution of underyearlings of the pike-perch ($r = 0.91 \pm 0.08$ at $n = 25$ and $p = 0.95$) and the Azov roach ($r = 0.89$ at $p = 0.95$ and $n = 24$.). A correlation has been found to exist between the distribution of the pike-oerch and the size of zones with favorable salinity ($r = 0.88 \pm 0.09$ at $p = 0.95$ and $n = 23$). It has been established that the difference between salinity values at stations where the feeding capacity for the Azov roach is high and low is constant although slight (0.2 - 0.3 ‰); the benthic biomass is invariably higher at the reduced salinity ($r = -0.09 \pm 0.04$ at $p = 0.95$ and $n = 24$.

14914. Legeza, M. I. (Azerbaydhanian Dept., Central Sturgeon Fish. Res. Inst. (TsNIORKh), Baku, USSR). 1971. FEATURES OF THE BIOLOGY OF CASPIAN STURGEONS (FAM. ACIPENSERIDAE) AND THEIR USE IN THE PROPAGATION OF STOCKS. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 354-362.

On the basis of data in the literature and the author's own studies characterizing the dynamics of catches, biological features and the distribution of sturgeons, recommendations are made concerning the most rational proportions of species to be artificially propagated.

14915. Zhiteneva, L. D. (Murmansk Marine Biol. Inst., USSR Acad. of Sciences, Dal'nyye Zelentsy, USSR). 1971. COMPOSITION OF THE BLOOD OF THE NINESPINE STICKLEBACK [Pungitius pungitius (L.)] UNDER CONDITIONS OF ADVERSE OXYGEN REGIME. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 409-417.

A study has been made of the composition of the blood of the ninespine stickleback introduced into a lake with an adverse oxygen regime in the winter and spring. At the beginning of the winter under conditions of oxygen deficit (1.5-2 months) erythrocytes stored in the spleen are released into the blood. An anemic state begins after 4.5-5 months. The rate of hematopoiesis rises. In the peripheral blood there is an increase in the percentage of immature erythrocytes and of the phagocytic cells of the white blood. If the stickleback exists for more than five months under adverse oxygen conditions the hematopoietic organs become overstrained. Polymorphism is noted among the erythrocytes in the peripheral blood.

14916. Bushuyev, V. P. (Inst. of Marine Biol., Far Eastern Branch, Siberian Dept., USSR Acad. of Sciences, Vladivostok, USSR). 1971. INTERSPECIFIC DIFFERENCES IN THE HEAT RESISTANCE OF THE SPERM OF SOME PACIFIC SALMON (GENUS Oncorhynchus). Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 382-386.

Investigations were made of the temperature adaptations of three species of Pacific salmon which spawn in Lake Ushkovskoye (Kamchatka River basin). An attempt has been made to compare the heat resistance of the cells with environmental temperature conditions during the spawning and spawning migrations of the fishes.

14917. Mukhachev, I. S. (Siberian Fish. Res. Inst. (SibNIIRKh), Tyumen', USSR). 1971. THE RATE AT WHICH THE PERCH [Perca fluviatilis (L.)] POPULATES LAKES. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 421-423.

Generalizing the instances known to us of the appearance of perch in the lakes of Transuralia which suffer from periodic oxygen deficit, we may state that the perch reaches commercial abundance within 5-6 years of introduction into the lake, i.e. 2-3 years after the spawning of the first local generation. As a result a lake which is quite suitable for the fattening of pelyad and carp (natural reproduction of pelyad and carp is possible in some instances) is converted into a perch water and its economic exploitation is not very profitable (more often unprofitable).

14918. Shikhshabekov, M. M. (Dagestan Dept., Caspian Fish. Res. Inst. (KaspNIIRKh), USSR). 1971. RESORPTION OF THE GONADS IN SOME SEMI-DIADROMOUS FISHES OF THE ARAKUM LAKES (DAGESTAN ASSR) AS A RESULT OF THE REGULATION OF DISCHARGE. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 427-431.

Analysis of resorption of the sexual products in the roach, bream and carp showed that certain conditions are needed for normal development of the gametes and completion of the sexual cycle: the passage of the spawners to spawn at the right time before spawning temperatures are reached, and a certain hydrologic regime throughout the entire spawning period (April-July). If these conditions are not observed there is mass resorption of the ova and, consequently, a reduction in the reproduction of semi-diadromous fishes under the conditions of regulated discharge of the Arakum lakes.

14919. Korovina, V. M., and N. Ye. Vasil'yeva (Ichthyological Lab., Zool. Inst., USSR Acad. of Sciences, USSR). 1971. A COMPARATIVE HISTOLOGICAL STUDY OF THE MIDGUT OF SOME SALMONIDAE. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 403-409.

The investigation has revealed great similarity in the histological structure of the anterior division of the midgut in members of six genera of the family Salmonidae which feed differently; this is connected with their possession of a stomach, as a result of which the food masses entering the intestine are largely digested.

14920. Krakatitsa, V. V., and M. F. Sapin (Azov-Black Sea Res. Inst. for Sea Fish. and Oceanogr. (AzCherNIRO), Kerch, USSR). 1971. A PELAGIC EGG INCUBATOR FOR USE ON SHIPS. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 431-435.

Great difficulty is usually encountered in the incubation of pelagic eggs under shipboard conditions. We have devised a special apparatus, an egg incubator for use on ships, which may be used on any vessel on which there is alternating current. The essential features of this apparatus are as follows: The entire system is enclosed in a thermally insulated casing. Incubation of the eggs takes place in incubation flasks under specified temperature conditions created by the functioning of a refrigeration plant and a heater which are automatically cut in by thermocontact regulators. Because the incubation flasks are spherical no water spills over the edge if there is sharp rolling or pitching. A water-level regulator excludes complete draining of water from the incubation flasks. Continuous flow is maintained in the incubation flasks by a reserve water tank. Cleaning is effected

by the fact that dead eggs and prolarvae which sink to the bottom of the flasks are incorporated in the flow system of the water and removed from the flasks. The effect of the vibration and rocking of the vessel is eliminated by a system of universal joints with shock absorbers. In addition to the incubation flasks supplied with running water, there are in the thermally insulated casing other flasks mounted on universal joints with shock absorbers; these flasks, which are also spherical in shape, do not have running water and water-level regulators. The air in the casing is circulated by automatically operated fans. Provision has been made for a system for the enrichment of the water with oxygen which is brought into operation in case of need. Natural illumination in the thermally insulated casing is provided by a window of transparent plastic with matt and blue filters.

14921. Kokhanova, G. D., G. D. Polyakov, and V. V. Rubtsov (Ukrainian Fish. Res. Inst., Kiev, USSR). 1971. COMPARATIVE EVALUATION OF UNDERYEARLING WILD CARP [Cyprinus carpio (L.)] OBTAINED FROM ADHESIVE AND DEGUMMED EGGS. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 435-438.

Fish farm indices and the results of a biostatistical investigation of the size and weight structure of a stock show quite convincingly that disturbance to the normal course of embryogeny of the wild carp as a result of the degumming of the eggs and their subsequent incubation in a mobile state had an adverse effect on the general biological condition of the fish which also extended to the following stages of ontogeny (at least to the underyearling stage); there was simultaneous deterioration in the economically useful characteristics of the young carp. Conversely, the wild carp underyearlings from adhesive eggs incubated in an immobile state (attached to the troughs) were found at all events to be no worse than underyearlings obtained as a result of natural spawning and subsequent rearing of the young in the growth ponds of the Poltava fish combine.

14922. Zhiteneva, T. S. (State Res. Inst. for Lake and River Fish. (GosNIORKh), Leningrad, USSR). 1971. MORPHOLOGICAL CHARACTERS OF YOUNG BREAM INHABITING THE ZONE AFFECTED BY THE WASTE WATER OF THE KONAKOVO POWER STATION. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 439-443.

Young bream 2+ years old inhabiting the zone of waste water from Konakovo power station are characterized by a lower figure of relative body depth than young bream from other areas of the reservoir. This is explained by the adverse feeding conditions which have formed for the bream in the zone of waste water from the power station. The morphological features which distinguish young bream of the warm water zone from the young of other areas of the reservoir (low body depth, greater range of variation in the relative magnitude of a number of characters) justify the assumption that the young bream keep to permanent feeding grounds in the spring, summer and fall, and that one of these is the warm water zone.

14923. Tsepkin, Ye. A., and L. I. Sokolov (Dept. of Ichthyology, Moscow State Univ., USSR). 1971. THE MAXIMUM SIZE AND AGE OF SOME STURGEONS. Journal of Ichthyology published by Amer. Fish. Soc., 11(3): 444-446.

The maximum size and life span of food fishes is a question which is not without theoretical and practical importance. A knowledge of the maximum age of a given fish species makes it possible to determine the coefficient of natural mortality, and this index is essential for biologically sound recommendations for rational exploitation. The present communication contains data on four species of the family Acipenseridae: beluga, Russian sturgeon, sevryuga and sterlet. Beluga [Huso huso (L.)]. According to published data, the greatest total length of specimens of this species does not usually exceed 4 - 5 m. Three belugas 400, 490 and 490 cm long were caught in the North and Middle Caspian in 1937 - 1940; their age ranged from 91 years to 118 years. The largest beluga known was caught in the North Caspian in 1940; the total length of this fish was 576 cm. Russian sturgeon [Acipenser guldenstadti (Brandt)]. According to L. S. Berg (1948), the largest specimens of this species are no more than 2.3 m long. The maximum age of present day specimens is 48 years. Sevryuga [Acipenser stellatus (Pallas)].

According to the data of K. G. Doynikov (1936), the sevryuga reaches a length of 180 cm. The life span of present day specimens of this species is approximately 30 years. Sterlet [Acipenser ruthenus (L.)]. The largest sterlet on which we find a published reference was caught in 1849 in the Volga, 112 km below Saratov; it was 1 m long. The maximum age of a sterlet determined from material from the Berezovka settlement was 26 years.

14924. Menshutkin, V. V., and T. I. Prikhod'ko. 1971. MATHEMATICAL MODEL OF VERTICAL DISTRIBUTION AND PRODUCTION OF PHYTOPLANKTON. Hydrobiological Journal published by Amer. Fish. Soc., 7(2): 1-6.

A description of computer simulation of the vertical distribution and production of plankton is given. The inputs include the illumination of the water surface, distribution of the water temperature in terms of depth and time, and initial concentration of biogenic elements. Study of the model revealed a dynamic picture of phytoplankton production throughout the body of water, vertical distribution of the phytoplankton biomass, and concentration of biogens consistent with known data obtained by direct observations of these factors.

14925. Stolbunov, A. K. 1971. PHENOL- AND THIOCYANATE-DECOMPOSING BACTERIA AS A FACTOR IN THE NATURAL PURIFICATION OF THE DNIEPER RESERVOIRS. Hydrobiological Journal published by Amer. Fish. Soc., 7(2): 6-14.

Statistical analysis revealed a moderate positive correlation between the phenol-decomposing activity of water and its content of phenol-decomposing bacteria, especially in the upper and most polluted parts of reservoirs. It also revealed a strong positive correlation between the abundance of saprophytic and phenol-decomposing bacteria. The phenol- and thiocyanate-decomposing bacteria act together with the physicochemical processes in the self-purification of water and its degradation of phenols and thiocyanates.

14926. Shpet, G. I., N. N. Kharitonova, and S. M. Panchenko. 1971. SANITARY AND BIOLOGICAL REASONS FOR THE USE OF LIME TO FERTILIZE FISH-BREEDING PONDS. Hydrobiological Journal published by Amer. Fish. Soc., 7(2): 38-43.

Lime is recommended for ponds with acid water or benthic deposits. Lime has also been shown to have a beneficial effect when the pH is alkaline. The modern fish-breeding practice of dense stocking of fish results in pollution of the ponds. The lime precipitates this excess organic matter, and its decay becomes a slow process.

14927. Gal'tsova, V. V. 1971. QUANTITATIVE COUNT OF MEIOBENTHOS. Hydrobiological Journal published by Amer. Fish. Soc., 7(2): 116-120.

L. L. Chislenko's separator, a device to accelerate the counting of meiobenthic organisms, is recommended for processing samples. When the separator is used, the error in calculating the number of organisms for the entire sample is no greater than a factor of 1.4 to 1.5. The lower limit of the absolute number of organisms for which this error is insignificant is measured in hundreds of individuals. The distribution of organisms in the sectors of the separator can be considered equiprobable. Slight differences in the areas of the sectors can be ignored. The order in which organisms are taken from the sectors of the separator has virtually no effect on the final results. A separator with an accessory divider to mix the sample is suggested as a means of obtaining more precise data.

14928. Sukhanov, V. V., and A. P. Shapiro. 1971. SELECTIVE FEEDING OF AQUATIC ORGANISMS. Hydrobiological Journal published by Amer. Fish. Soc., 7(2): 50-55.

A model of selective feeding of a predator on several species of prey is based on V. S. Ivlev's experiments. Some properties of the model are mentioned. An example of the relations between predator and prey is analyzed in accordance with the model.

14929. Lugovaya, T. V. 1971. THE RATION OF PIKE IN THE KREMENCHUG RESERVOIR. Hydrobiological Journal published by Amer. Fish. Soc., 7(2): 112-115.

The main source of food for the pike in the Kremenchug reservoir during the year is Blicca bjoerkna, roach, and perch, which constitute about 76% of the weight and 88% of the number of all food organisms consumed. By knowing the size of the ration and food utilization coefficients for the different pike age groups, as well as the percentage of individual species in the composition of its food throughout the year, we can not only calculate the total amount of food that it consumes to gain 1 kg of weight but also determine the share of the individual feed fish species in its feeding. According to our calculations, a pike weighing 1 kg (about 50 cm long) consumes 6.27 kg of fish during its lifetime, but the percentage of commercially valuable fish in its diet is negligible. The food utilization coefficient increases with increasing weight and size of the pike at the same time that the share of commercially valuable fish in its ration grows. It is desirable, therefore, that the large pike be fished from the fall to early spring when it forms large schools and is more easily caught. By knowing the annual ration of the pike in calories and the food utilization coefficient for different size groups, one can always determine the growth increment: $G\ (cal) = \frac{R}{FC}\ (cal)$. To translate energy units into weight units, it is necessary to divide the growth increment in calories by 1000 (caloric content of 1 g of wet weight of fish = 1000 cal): $G\ (g) = \frac{G(cal)}{1000}$. The general formula for determining growth increment in grams is: $G\ (g) = \frac{D(cal)}{FC \cdot 1000}$. Our findings on the annual ration of pike from the Kremenchug reservoir and on the food utilization coefficients in the different stages of its life permit a more objective evaluation of the role of this predator in a body of water. They can also be used to work out feeding rates in pond culture.

14930. Shnarevich, I. D., and S. S. Starik. 1971. ROLE OF ARTIFICIAL RAPIDS IN THE CREATION OF A FOOD SUPPLY FOR THE TROUT STOCK IN MOUNTAIN STREAMS OF THE UKRAINIAN CARPATHIANS. Hydrobiological Journal published by Amer. Fish. Soc., 7(2): 68-74.

Rapid-creating dams and weirs on mountain streams of the Ukrainian Carpathians are an effective means of increasing the natural reproduction of Salmonidae. They help to improve the oxygenation of the water which, in turn, results in increased abundance and biomass of the benthic population (by 24.6 and 11.9 to 13.6%, respectively) The location and design of the rapids should be in harmony with the specific characteristics of flow of the given mountain river.

14931. Bugay, K. S. 1971. REPRODUCTION OF THE BLACK SEA PIKE PERCH (Lucioperca marina Cuv.) IN THE DNIEPER-BUG ESTUARY. Hydrobiological Journal published by Amer. Fish. Soc., 7(2): 75-80.

Present-day range of the Black Sea pike perch in the Dnieper-Bug estuary, main spawning places, depth, ground, salinity, water temperature and pH, characterization of the size and age composition of the fish, spawning times, and fecundity are discussed.

14932. Denisova, A. V., G. V. Popova, and I. G. Pushkar. 1970. CHRONIC EFFECTS OF HERBICIDES DERIVED FROM UREA ON FISH AND THEIR FOOD. IUCN (Int. Union Conserv. Nature Natur. Resour.) Publ. N S. 17: 103-106.

AUTHOR INDEX

Abbott, Robert Riley, 14728
Abe, Isao, 14834
Ager, Lothian, 14661
Ahlstrom, Elbert H., 14645
Alderdice, D. F., 14602
Allen, K. Radway, 14604
Alpaugh, Walter C., 14748
Andrews, Austin K., 14724
Andrews, James W., 14733, 14892 14893
Antonini, Eraldo, 14694
Aoe, Hiroshi, 14834
Aoki, Takashi, 14837
Arai, Hisao P., 14606
Armstrong, F. A. J., 14590, 14762
Arnold, C. R., 14793
Avedikova, T. M., 14913
Avtalion, R. R., 14597

Bach, R., et. al., 14624
Bache, Carl, 14618, 14620
Bagenal, T. B., 14907
Bahns, Timothy K., 14906
Bahr, Thomas G., 14715
Bailey, William, 14682
Bakkala, Richard G., 14633
Baptist, J. P., 14588, 14764
Barkley, Sammy W., 14666
Barlow, George W., 14747, 14813
Barraclough, W. E., 14647
Barry, Thomas L., 14622
Bartnik, V. G., 14804
Bates, Daniel W., 14772
Bayliff, William H., 14632
Beam, Martin G., 14772
Beamish, F. W. H., 14627, 14805
Beamish, R. J., 14759
Becker, C. D., 14721
Bedinger, C. A., Jr., 14790
Bell, Gordon R., 14601
Bellinger, John W., 14674
Bellman, Sander W., 14622
Benville, P. E., Jr., 14718
Berdyshev, G. D., 14800
Berinati, D. J., 14711, 14771
Bhatia, H. L., 14745
Bilton, H. T., 14760, 14761
Binotti, Ines, 14694
Blazek, D., 14692
Bobrova, Yu. P., 14737
Boddingius, J., 14635
Bodien, Danforth G., 14720
Bond, H. W., 14905
Bortone, Stephen A., 14641
Boyd, Randy, 14677, 14682
Brand, James S., 14700
Brauhn, James L., 14704
Brett, J. R., 14611, 14825
Briggs, Kenneth T., 14817
Briggs, Philip T., 14613
Brinkhurst, R. O., 14753, 14754, 14755
Brown, Bradford E., 14679
Brunori, Marizio, 14694
Brunskill, G. J., 14762
Bugay, K. S., 14931
Burns, James W., 14725
Burrell, Victor G., Jr., 14690
Burress, Ralph M., 14673
Burton, Dennis T., 14881, 14906
Bushuyev, V. P., 14916
Butler, D. P., 14702
Butler, David G., 14883
Byrne, John E., 14630

Cahn, Phyllis H., 14654
Caillouet, Charles W., 14701
Cairns, John, Jr., 14773, 14906
Calaprice, J. R., 14605
Carnes, W. Cape, 14658
Carpenter, M. Ralph, 14895
Carter, W. R., III, 14686
Chamberlain, Lawrence L., 14814
Childers, William F., 14799, 14886
Chittenden, Mark E., Jr., 14739
Cho, Paula L., 14886
Christensen, G. M., 14640
Chua, Dixie, 14803
Collins, Richard A., 14676
Cook, David W., 14716
Cornford, Neri E., 14691
Cotton, Dan, 14675
Cragg-Hine, D., 14787
Cross, D. G., 14746
Cross, Ford A., 14764
Crowley, G. J., 14711, 14771
Crumpton, Joe, 14667
Cuinat, R., 14904
Cullen, M. C., 14621
Cushing, C. E., 14696
Czeczuga, B., 14792

Dalforno, S., 14853
Darlington, Robert W., 14862
Davis, C. William, 14817
Davis, John C., 14609
Davis, Robert M., 14894
Dawson, C. E., 14670
Dawson, Verdel K., 14734
Degurse, Paul E., 14585
Denisova, A. V., 14932
Deutsch, Maurice, 14626
de Vlaming, Victor L., 14789, 14813
DeWilde, Mary Anne, 14788
Dickson, Kenneth L., 14906
Dill, Lawrence M., 14899
Dixon, Gordon H., 14778
Dockray, Graham J., 14809
Doty, Maxwell S., 14793

Douglas, John, 14727
Drucker, Benson, 14649
Duedall, I. W., 14770
Duke, Thomas W., 14586
Dumas, Richard F., 14700
Dunbar, Clarence E., 14693
Dunson, William A., 14810

Eales, J. G., 14803
Echelle, Anthony, 14756
Egusa, Syuzo, 14837
Elder, J. H., 14692
Elliott, M. J., 14907
Engelbert, Vibeke E., 14626
Evelyn, T. P. T., 14610

Fabian, B. C., 14798
Fairbanks, Deborah, 14869
Fallaux, E. M., 14635
Falls, C. Paul, 14751
Fatora, Joseph R., 14687
Fearnhead, E. A., 14798
Fenderson, Owen C., 14895
Fimreite, N., 14593
Fisher, Paul B., 14785
Fitzgerald, George P., 14623
Frey, John E., 14664
Fromm, P. O., 14882
Fryer, J. L., 14703
Fujihara, M. P., 14758
Fuller, G. C., 14905

Galat, David L., 14712
Gal'tsova, V. V., 14927
Gardner, Linda, 14608
Garriott, David D., 14660
Gee, Phyllis A., 14625
Ghittino, P., 14853, 14889
Gibson, David I., 14781
Gibson, James R., 14898
Giger, Richard D., 14774
Gillespie, D. C., 14766
Giovenco, Silvia, 14694
Girsa, I. I., 14875
Godwin, Don S., 14677
Gordy, Herbert R., 14651
Gorlin, E., 14597
Gorodnichiy, A. Ye., 14911
Grant, George C., 14690
Gray, D. Leroy, 14677
Gray, John S., 14685
Grinstead, Bobby G., 14678
Gruchy, I. M., 14593
Gutwirth, E., 14597

Haastein, T., 14644
Hackney, Peter A., 14683
Hagiya, Koichi, 14636
Hakala, Ilpo, 14822
Hamai, Ikuso, 14827
Hansen, Edward A., 14589
Hanyu, Isao, 14831, 14832
Hara, Takeshi, 14840
Harman, Paul D., 14680
Hartman, G. F., 14631
Hasanen, Erkki, 14818
Hastings, W. H., 14702
Hayashi, Seiichi, 14846
Heath, Alan G., 14884
Heland, M., 14901, 14903
Heritage, G. D., 14825
Herman, Roger Lee, 14693
Herring, Jack, 14675
Hibiya, Takashi, 14831, 14832, 14840
Hill, Loren G., 14791
Hill, Thomas K., 14656
Hilliard, D. K., 14629
Hirano, Katumi, 14835
Hodgkiss, W., 14601
Holder, Daniel R., 14684
Holliday, F. G. T., 14784
Holmgren, S. K., 14762
Holsworth, W. N., 14593
Holt, G., 14644
Hooper, Gerald R., 14683
Hoskins, Gary E., 14601
Hoss, D. E., 14588
Houston, Arthur H., 14788
Hubbs, Clark, 14750
Huckins, James N., 14887
Hudson, Patrick L., 14655
Hughes, Janice S., 14669
Huish, Melvin T., 14708
Hulth, L., 14639
Hurlbert, Stuart H., 14869
Hurley, Donal A., 14713

Igarashi, Hisanao, 14829
Ikeda, Shizunori, 14841, 14849, 14850
Imura, Koji, 14854
Itazawa, Yasuo, 14838

Jenkins, Robert E., 14643
Jensen, A. L., 14880
Jernelöv, Arne, 14861
Johnson, Donald W., 14749
Johnson, M. G., 14753, 14754, 14755
Johnson, Paul W., 14793
Johnson, Sven I., 14699
Jones, S., 14645
Joseph, Edwin B., 14890
Joy, James E., 14811

Kabata, Z., 14603
Kalal, L., 14587
Kanno, Yasuji, 14827
Kariya, Teiji, 14839
Katz, E., 14597
Kawai, Akira, 14855, 14856, 14858
Kawai, Shin-ichiro, 14841

Kawazu, Kazuyoshi, 14637
Kazlauskene, O. P., 14863
Keenleyside, Miles H. A., 14802
Keith, J. A., 14593
Keith, William E., 14666
Kennedy, O. D., 14648
Kepshire, Bernard M., Jr., 14650
Kerce, King E., 14661
Kerstetter, Theodore H., 14779
Kevern, Niles R., 14698
Khalturin, D. K., 14912
Kharitonova, N. N., 14743, 14926
Kihlstrom, J. E., 14639
Kimura, Shigeru, 14636
Kionka, B. C., 14768
Kirschner, Leonard B., 14779
Klawe, Witold L., 14645
Kleinert, Stanton J., 14585
Kobayashi, Shozo, 14839
Kochsiek, Kenneth A., 14752
Kokhanova, G. D., 14921
Konchin, V. V., 14873
Kono, Hideo, 14836
Koo, Ted S. Y., 14891
Korniyenko, G. S., 14871
Korotkevich, O. S., 14776
Korovina, V. M., 14919
Kott, E., 14595
Kozlowski, Feliks, 14617
Krakatitsa, V. V., 14920
Krantz, George E., 14891
Kriete, William H., Jr., 14690
Krupauer, V., 14736
Kubota, Minoru, 14636
Kuznetsov, V. A., 14866

LaBar, George W., 14729
Lachner, Ernest A., 14643
LaLanne, John J., 14634
Lann, Hans, 14861
Lanza, Guy R., 14773
Lapi, L. A., 14605
Larkin, P. A., 14599
Larsen, C. M., 14628
Lasker, Reuben, 14814
Lau rence, Geoffrey C., 14607, 14786
Lea, Robert N., 14816
LeBrasseur, R. J., 14648
Legeza, M. I., 14914
Leith, D. A., 14703
Lembi, C. A., 14692
Leteux, Frank, 14706
Lewis, C. W., 14588
Lewis, Robert M., 14651
Lewis, Steven A., 14660
Liang, J. K., 14688, 14806
Lighthill, M. J., 14878
Lindahl, P. E., 14860
Lindberg, G. U., 14910
Lisk, Donald J., 14618, 14620
Louder, Darrell E., 14658
Lovell, R. T., 14638, 14688, 14806
Lovett, Raymond J., 14900
Ludke, J. Larry, 14898
Lugovaya, T. V., 14929
Lumare, F., 14888
Lundberg, C., 14639
Lusk, Christina I., 14898
Lutz, Peter L., 14807, 14808

MacFarlane, A., 14784
Major, Richard L., 14653
Makeyeva, A. P., 14865
Maletto, S., 14889
Mann, Hans, 14777
Marek, M., 14598
Marking, Leif L., 14592, 14707, 14734
Martin, F. Douglas, 14732
Martin, J. Mayo, 14677
Maslennikova, N. V., 14872
Massaro, Edward J., 14885
Masuda, Isao, 14834
Mathis, William P., 14677
Mathur, Dilip, 14663, 14877
Matsumoto, Walter M., 14645
Mauck, Paul E., 14662, 14689
Mayerle, Joan A., 14883
McCarraher, D. B., 14769
McCauley, R. W., 14765
McCleave, James D., 14729
McCosker, John E., 14767
McGuinness, E. T., 14621
McKone, Colin, 14618
McLain, L. R., 14780
McNeil, William J., 14650
McSheffrey, H. M., 14605
Meade, T. G., 14790
Menshutkin, V. V., 14864, 14924
Mensinger, Gary, 14662, 14672, 14689
Metcalf, Robert A., 14799
Metcalf, Robert L., 14799
Meyer, Fred P., 14677, 14706
Meyers, S. P., 14702
Micha, J.-C., 14902
Miller, Roy W., 14710
Miller, Rudolph J., 14782
Minckley, W. L., 14749
Mitsui, Tetsuo, 14637
Moore, K. D., 14703
Moore, Keith L., 14625
Moravec, F., 14606
Morgan, Raymond P., II., 14891
Morgenthaler, L. P., 14719
Morre, D. J., 14692
Morrison, Robert, 14752
Mosher, Kenneth H., 14652
Movchan, N. A., 14776
Mukhachev, I. S., 14917
Munro, A. L. S., 14783
Murphey, Ernest W., 14772

Nagahisa, Eizo, 14820
Nagai, Masanori, 14849, 14850
Nakatani, R. E., 14758
Nanba, Kenjo, 14839
Napravnik, J., 14587
Nicholson, B. L., 14615
Nigrelli, Ross F., 14767
Nikol'skii, G. V., 14742
Niwa, Hiroshi, 14844
Nose, Yukio, 14836
Nuorteva, Pekka, 14818

O'Connor, Joel S., 14613
Ogawa, Akira, 14829
Oguri, Mikio, 14848
Okada, Shun, 14824
Olson, K. R., 14882
Olson, P. A., 14758
Ooshiro, Zentaro, 14833, 14851, 14859
Ota, Toru, 14828

Packer, Randall K., 14810
Panchenko, S. M., 14926
Panov, D. A., 14744
Pardue, Garland B., 14656
Parker, Robert R., 14600
Parks, Robert P., 14709
Parsnitskaja, A. I., 14800
Parsons, T. R., 14646
Paulik, Gerald J., 14653
Peakall, David B., 14900
Pearce, P. A., 14593
Pennsylvania State University, 14908
Peters, H. M., 14616
Peterson, G. L., 14794
Pickering, Alan D., 14809
Pigg, Jimmy, 14750
Pike, David J., 14642
Pimentel, David, 14717
Plumb, John A., 14735, 14797, 14812
Poluhowich, John J., 14709
Polyakov, G. D., 14921
Pond, W. L., 14765
Popova, G. V., 14932
Prather, E. E., 14638
Prikhod'ko, T. I., 14924
Pushkar, I. G., 14932

Rachlin, Joseph W., 14785
Rand, S., 14896
Rass, T. S., 14910
Rasskazov, V. A., 14800
Rausch, R. L., 14629
Rawstron, Robert R., 14819
Reinert, Robert, 14584, 14796
Richards, William J., 14645
Ricker, W. E., 14612
Riggs, Carl D., 14756
Roberts, B. L., 14879
Roberts, Ronald J., 14783, 14852
Robins, G. L., 14760, 14761
Robinson, D., 14647
Robison, Henry W., 14782
Rosen, Moe Wm., 14691
Rosenthal, H., 14795
Ross, A. J., 14705
Rubtsov, V. V., 14921
Ryan, K. P., 14879

Sabodash, V. M., 14775
Saito, Takashi, 14834
Sakata, Kanzo, 14637
Saksena, Vishnu P., 14890
Sanders, J. E., 14703
Sanders, Marilyn M., 14778
Sandow, Jack Thomas, Jr., 14659
Sano, Tokuo, 14843, 14845
Sapin, M. F., 14920
Sargent, M., 14692
Sarig, S., 14594, 14598
Sastry, Akella, 14793
Savina, R. A., 14740
Schindler, D. W., 14762
Scholl, Russell L., 14619
Schwanbom, E., 14860
Scott, D. P., 14766
Seehorn, Monte E., 14657
Seki, Nobuo, 14842, 14847
Shapiro, A. P., 14928
Sharp, R. W., 14722
Shaw, Stanton B., 14815
Shcherbina, M. A., 14863
Shearer, W. M., 14783
Shehader, Z. H., 14794
Shikhshabekov, M. M., 14918
Shimazaki, Kenji, 14826
Shnarevich, I. D., 14930
Shpet, G. I., 14926
Shumilov, I. P., 14870
Siębers, D., 14795
Sieburth, John McN., 14793
Sills, Joe B., 14680
Smith, Barry W., 14656
Smith, C. E., 14780
Smith, G. R., 14868
Snow, J. R., 14681
Snyder, Diane, 14584
Snyder, George R., 14591
Sokolov, L. I., 14923
Sorokin, Yu. I., 14744
Southward, G. Morris, 14727
Sparks, Richard E., 14906
Spehar, Andrea M., 14881
Stalling, David L., 14887
Starik, S. S., 14930
State Fish and Game Depts., The, The National Conservation Organizations, and The Bureau of Sport Fish. & Wildl., U. S. Dept. of Interior, 14909

Stauffer, Thomas M., 14726
Steele, Robert G., 14802
Stelzer, R., 14795
Stephens, K., 14646
Stickney, Robert R., 14733, 14892
Stolbunov, A. K., 14925
Strand, J. A., 14695
Sugahara, Isao, 14855, 14856, 14858
Sugiyama, Motohiko, 14858
Sukhanov, V. V., 14928
Sumari, Olli, 14821
Summerfelt, Robert C., 14662, 14665
Suppes, V. Charles, 14697
Sutherland, D. B., 14825
Sutterlin, A., 14896
Sutterlin, N., 14896
Symons, Philip E. K., 14763

Tabata, Mitsuo, 14844
Tafanelli, R., 14689
Tajima, Yukiko, 14834
Takahashi, M., 14646
Takashima, Fumio, 14840
Talbot, G. B., 14699
Tamura, Tamotsu, 14844, 14857
Tangen, E. G., 14695
Taniguchi, Akira, 14824
Tarasova, O. M., 14743
Tarr, H. L. A., 14608
Taub, Stephen H., 14714
Templeton, W. L., 14695
Tenaza, Richard H., 14814
Tindle, R. C., 14718
Toole, Joe E., 14723
Tsai, Chu-fa, 14731
Tsepkin, Ye. A., 14923
Tsuchiya, Yasuhiko, 14820
Tsuyuki, H., 14759
Turdakov, A. F., 14867
Turner, Paul R., 14665
Tuunainen, Pekka, 14897
Tyler, A. V., 14757
Tytler, P., 14784

Uchida, Naoyuki, 14823
Ueyanagi, Shoji, 14645
U. S. Dept. of Interior, Bur. of Comm. Fish., 14614
Uthe, J. F., 14590
Uyeno, Teruya, 14868

Varga, Louis P., 14751
Vasil'yeva, N. Ye., 14919
Velsen, F. P. J., 14602
Verigin, B. V., 14742, 14865
Villani, P., 14888
Voropaev, N. V., 14738

Wagner, Wilbert C., 14730
Walker, Charles R., 14583
Wallace, Dale C., 14866
Waller, William T., 14906
Ware, Forrest J., 14671
Watanabe, Takeshi, 14840
Watson, D. G., 14696
Webb, Joseph F., 14683
Whitt, Gregory S., 14799, 14886
Wiggs, Alfred J., 14801
Wilhm, Jerry L., 14752
Wilkens, E. Peter H., 14651
Williams, DeWayne A., 14774
Williams, Hampton M., 14668
Willis, James N., 14764
Windell, J. T., 14768
Wolf, Ken, 14862

Yamada, Juro, 14830
Yamada, Minoru, 14828
Yamamori, Kunio, 14831, 14832
Yarzhombek, A. A., 14872
Yashouv, A., 14596
Yone, Yasuo, 14835
Yonezawa, Katsuyuki, 14857
Young, A. H., 14784

Zama, Koichi, 14829
Zaugg, W. S., 14780
Zedler, Joy, 14869
Zhiteneva, L. D., 14915
Zhiteneva, T. S., 14922
Zillich, John A., 14875
Zubareva, E. L., 14741

SUBJECT INDEX

Age and growth,
barbel in Ourthe River, 14902
bass, striped, from winter gillnet catches in Rappahannock River, 14690
carp, grass, in Russian fish-farm ponds, 14737
catfish, channel, re temperature and dietary lipids, 14892
dace, rosyside, 14894
feeding frequency for a maximum daily ration, re 6 fishes, 14836
grayling in Ourthe River, 14902
menhaden, young, in White Oak River estuary, North Carolina, 14651
perch, European, rate at which it populates lakes, 14917
redhorse, silver, in Flint River, Alabama, 14683
salmon,
chinook, premigratory-, in seawater, 14650
chum, marine growth, 14634
sockeye,
juvenile, effect of fertilization of Great Central Lake, 14647
responses of young to different diets, 14611
sturgeons, maximum size and age, USSR, 14923
trout,
brown, biology re commercial size in Karelian lakes, 14912
in Finnish lakes treated with rotenone, 14897
rainbow, juvenile, in a Lake Michigan tributary, 14726

Anatomy,
anomalies of fishes, bibliography, supplemental listing, 14670
caeca, pyloric,
alkaline RNA-hydrolyzing enzyme in, rainbow trout, 14854
of mackerel, properties of proteinase from,14833
description of young menhaden in White Oak River estuary, North Carolina, 14651
dimorphism, sexual, re chromatin patterns in fishes, 14625
epiphysis cerebri of fish, slow potential from, 14844
eye-lines of fish, attitude of - re body shape and stripes and bars, 14747
gill ultrastructure of Monodactylus argenteus, changes with varying salinity, 14798
gills, chloride transport by, in rainbow trout, 14779
lateral-line,
sense organs, fine structure of in dogfish, 14879
system of fishes, nervous connections between neuromasts, 14616
liver,
degradation of adenosine 5'-monophosphate in, rainbow trout, 14847
post-mortem degradation of nucleotides in, rainbow trout, 14842
midgut of Salmonidae, comparative histological study of, 14919
morphological features of silver carp and bighead, and hybrids, 14738
morphology of bream inhabiting warm water from power station, 14922
pituitary of freshwater fish, histology of ACTH cells in, 14848
scale features of sockeye from Asian and North American coasts, 14652
scales,
fine structural aspect of, in chum salmon fry, 14830
of young sockeye, starvation, feeding and light re circulus formation, 14760
skin, seasonal change of purine content of, in masu from parr to smolt, 14846
testis,
salmon, immature-, ribonucleotide reductase in, 14608
trout, phosphorylation sites in protamine biosynthesis, 14778

Bacteriology,
Aeromonas
liquefaciens,
agent of hemmorrhagic septicemia of carp, furazolidone for control of, 14617
from freshwater fishes, re drug sensitivity, 14837
salmonicida from sablefish and salmon, 14610

Bacteriology, cont.
bacteria,
associated with surface of stream-incubating Pacific salmon eggs, 14601
growing on pelyad spawn, 14776
phenol- and thiocyanate-decomposing-, re natural purification of Dnieper Reservoirs, 14925
bacterial fish pathogens, in vitro studies of nifurpirinol (P-7138) against, 14705
bacteriological study on death of fish during transportation, 14835
Chondrococcus columnaris, susceptibility of juvenile salmonids to, 14758
Clostridium botulinum, tank trout as carriers of, detection, 14624
Leucothrix mucor infestation of benthic crustacea, fish eggs and algae, 14793
nitrogen-fixing bacteria,
distribution in,
fresh waters, 14855
sea waters, 14856
in culture ponds, 14858
Vibrio anguillarum, re vibrio disease in wild Norwegian fish, 14644

Behavior,
aggregation, induced-, of pond-reared rainbow trout thru acoustic conditioning, 14728
agonistic- and territorial-, first stages of, re brown trout in artificial brook, 14903
breeding habits of 2 subspecies of longnose dace, 14804
conquest of territory by brown trout re initial population density in artificial brook, 14901
feeding,
chronology and food habits of catfish in Conowingo Reservoir, 14663
of juvenile sockeye, re fertilization of Great Central Lake, 14647
flicker-ERG in rainbow trout, funa and eel, 14857
flight distance in zebra danio, determined by visual mechanism, 14899
locomotor-, small sonic tag for measuring, 14784
mate selection in pumpkinseed and longear sunfish, 14802
nest-digging-, of rainbow trout, 14631
orientation of young fishes in a photobarogradient chamber, 14874
respiration, aerial, of young gars, social aspects, 14791
salmon, Atlantic, hatchery- and wild-, effects of crowding on, 14895
schooling,
estimating distances between fish in aquarium, 14763
of tuna, sensory factors in positioning, 14654
spawning-, of silver redhorse in Flint River, Alabama, 14683
swimming ability of fed and starved larval bass, 14786
temperature selection of trout fingerlings vertically and horizontally, 14765

Benthos,
Chironomidae of South Dakota, 14655
community metabolism in Bay of Quinte and Lake Ontario, 14755
crayfish, exploitation by bass in Ohio pond, 14714
effects of electrofishing on, in English stream, 14907
macroinvertebrates, Bay of Quinte and Lake Ontario,
associations and species, 14753
production, 14754
meio-, quantitative count of, 14927
mercury accumulation in food chains, 14861
re trout in Finnish lakes treated with rotenone, 14897
snails, correlation of structure vs. activity of freshwater pollutants, 14905
zoo-, improved sampling techniques re new model of Kajak sampler, 14822

Bibliography,
anomalies of fishes, supplemental listing, 14670
limnologists, fishery-, world list of, 14628

Biocides,
herbicides,
butyl ester of 2,4-D, tolerance of young striped bass to, 14669
copper sulfate, tolerance of young striped bass to, 14669
2,4-D,
fish toxicity, 14692
toxicological effects on fish et al., 14583
endothal, toxicological effects on fish et al., 14583
evaluation of algicides, 14623
karmex, tolerance of young striped bass to, 14669
picloram, fish toxicity, 14692
urea derivatives, chronic effects on fish and their food, 14932
insecticides,
aldrin, epoxidation in fishes re MFO enzymes, 14898
DDT,
in 8 California marine fishes, 14815
in Great Lakes fish, 14796
separated from PCB's on silica gel, 14584
dieldrin, in Great Lakes fish, 14796
dylox, tolerance of young striped bass to, 14669
ethyl parathion, tolerance of young striped bass to, 14669
methyl parathion, tolerance of young striped bass to, 14669
parathion, activation in fishes re MFO enzymes, 14898
molluscicides, correlation of structure vs. activity of freshwater pollutants, 14905
pesticides,
chlorinated-, chromatography-mass spectrometry of residues, 14622
2,4-dinitrophenol, effect on respiration in herring embryos, plus metabolite concentrations, 14795
dry ice homogenization for fish samples in residue analysis, 14718
effects on non-target species, 14717
HTH, tolerance of young striped bass to, 14669
in estuaries, 14586
residues of 20 Mississippi delta lakes, 14675
piscicides,
antimycin,
half-life of biological activity via fish bioassay, 14734
sensitivity of white amur to, 14707
antimycin-A, improved method of treating ponds for sunfish control, 14673
bayluscide, sensitivity of white amur to, 14707
huratoxin, isolation and characterization, 14637
juglone, sensitivity of white amur to, 14707
rotenone,
benthic fauna re trout in treated Finnish lakes, 14897
sensitivity of white amur to, 14707
salicylanilide I, sensitivity of white amur to, 14707

Chemical factors,
influencing local distribution of sheepshead minnow, 14732
Keystone Reservoir, Oklahoma, and species of net zooplankton, 14752
mercury,
accumulation in food chains, 14861
content in Myoxocephalus in Finland, 14818
occurrence and effects in ecosystem, 14900
nitrogen-fixing bacteria,
distribution in,
fresh waters, 14855
sea waters, 14856
in culture ponds, 14858

Chemical factors, cont.
oxygen,
adverse regime re blood composition of stickleback, 14915
depletion in eutrophic reservoir, continuous system models of, 14751
dissolved-,
minimum required for normal fish life, 14838
requirements of larvae of blenny, goby, skilletfish, 14890
three methods for determining concentrations near fish embryos, 14710
pH,
effect on toxicity of zinc to bluegill, 14906
low-,
and high content of Fe compounds, destructive effects on fish, 14587
anoxia and Na loss in death of brook trout at, 14810
salinity,
effect of stress on eggs and larvae of Salton Sea fishes, 14814
effects on early development of Pacific herring, 14602
tolerance of young blueback herring, 14739
seawater, tolerance of grass carp to, 14746
zinc localization in carp spawn, embryos and larvae, 14775
^{65}Zn and stable Zn, distribution in experimental marine ecosystem, 14764

Chemicals,
acid stress in fish, histochemical and cytophotometric assay of, 14908
chlorine residuals, toxicity to freshwater fish, 14875
PCB's,
chromatography-spectrometry characterization of, plus ^{36}Cl-labeling, 14887
in estuaries, 14586
potassium,
dichromate, 14669
permanganate, 14669
surfactants, synthetic, effect on olfactory function of Atlantic salmon, 14896
toxicological assays with fish, 14592

Culture,
acoustic conditioning for induced aggregation of pond-reared rainbow trout, 14728
aquaculture, high-density-, rotable cage for, 14701
attributes of silver carp and bighead, 14738
blood sample preservation for hemoglobin assay, 14711
cage-, of channel catfish in reservoir lakes, 14676
carp,
from adhesive and degummed eggs, comparative evaluation of, 14921
grass-
and silver-, propagation thru pituitary injection, 14865
spawning and rearing, 14682
catfish,
channel,
aquatic plants as ingredients in feeds for, 14688
dietary lipids and temperature re metabolism, growth and composition, 14892
feeding rates and temperature re growth, conversion and body composition, 14733
high-density-, stocking and water requirements for, 14893
circulating seawater system for studies with crabs, 14716
combined-, of carp and grass carps in Ukraine, 14743
crustacean-, alginates as binders for rations, 14702
diet and growth of grass carp in Russian fish-farm ponds, 14737
feeding frequency for a maximum daily ration, re 6 fishes, 14836
fish-,
in Israel in 1970, 14594
superintensive-, in Beith-Shean Valley, Israel, 1969-70, 14598

Culture, cont.
herbivorous fish,
experience in Czechoslovakia, 14736
in USSR, 14742
herring, Pacific, in the laboratory, 14699
incubator, pelagic-egg-, for use on ships, 14920
infestation of fish eggs by Leucothrix mucor, 14793
interaction between common carp and silver carp, 14596
jar incubation of channel catfish eggs, 14697
lime for fertilization of fish-breeding ponds, 14926
malachite green-formalin mixtures for control of ich and other protozoans, 14706
oxygen, dissolved, 3 methods for determining concentrations near fish embryos, 14710
phytophagous fishes, role of infusoria in food of larvae, 14871
pond-, -chemicals, tolerance of young striped bass to, 14669
ponds, nitrogen-fixing bacteria in, 14858
propagation of Caspian sturgeon stocks based on their biology, 14914
salmon, Atlantic, hatchery- and wild-, effects of crowding on, 14895
salmonid-hatchery wastes, evaluation of, 14720
sexing bluegills, method for, 14704
spawning, induced, of gilthead, Italy, 14888
tank trout as carriers of Clostridium botulinum, detection of, 14624
tannin solution used in walleye and carp culture, 14700
treatment,
of hatchery water supplies for control of Ceratomyxa shasta, 14703
with masoten for external parasites; determination of metrifonat residue, 14889
vitamin fortification, effect in Auburn No. 2 fish feed, 14638
walleye, observations on incubating eggs, 14713

Diet,
alginates as binders for crustacean rations, 14702
artificial food re fecundity of largemouth bass, 14681
carp, grass, in Russian fish-farm ponds, 14737
catfish, channel, nutritional value of water hyacinth in feeds, 14806
composition re metabolism of glucose-6-^{14}C in carp, 14850
digestibility of sunflower, lupin, rye and food mixture by carp, 14863
effect on glucose, glycogen and lipids in carp, 14849
lipids and temperature re growth, metabolism and composition of catfish, 14892
phytophagous fishes, role of infusoria in food of larvae, 14871
plants, aquatic, as ingredients in catfish feeds, 14688
re visceral granuloma in brook trout, 14693
vitamin,
fortification, effect in Auburn No. 2 fish feed, 14638
requirements, minimum-, for carp, 14834

Disease,
Aeromonas
liquefaciens, from freshwater fishes, re drug sensitivity, 14837
salmonicida from sablefish and salmon, 14610
bacterial,
fish pathogens, in vitro studies of nifurpirinol (P-7138) against, 14705
hemorrhagic septicemia of carp, furazolidone for control of, 14617
Ceratomyxa shasta, control by treating hatchery water supplies, 14703
channel catfish virus,
a new herpesvirus of ictalurids, 14862
research at Auburn University, Alabama, 14797
tissue distribution of, 14812
Clostridium botulinum, tank trout as carriers of, detection of, 14624
columnaris, susceptibility of juvenile salmonids to bacterium of, 14758

Disease, cont.
IPN,
first isolation from epizootics in Japan, 14843
of rainbow trout in Japan, pathogenicity of isolants, 14845
virus, effect of actinomycin D on multiplication of, 14615
lymphocystis, new records in 4 E. Pacific fishes, 14767
nephroblastoma, spontaneous, in a hatchery rainbow trout, 14853
parasitosis, determination of metrifonat residue after treating fish with masoten, 14889
UDN,
failure to detect epithelial auto-antibodies in sera from diseased fish, 14783
present state of knowledge on, 14852
re recruitment of salmonid populations of Lough Erne waters, 14787
vibrio-, in wild Norwegian fish, 14644
virus-caused epizootic of rainbow trout in Minnesota, 14735
visceral granuloma in brook trout, 14693

Distribution,
Diphyllobothrium spp., occurrence in Alaska, 14629
minnow, sheepshead, factors affecting locally, 14732
nitrogen fixing bacteria in,
fresh waters, 14855
sea waters, 14856
Nocomis biguttatus species group, 14643
orientation of young freshwater fishes in a photobarogradient chamber, 14874
phytoplankton, vertical, mathematical model of, 14924
pikeperch, European, in Sea of Azov, re environmental factors, 14913
roach, Azov, re environmental factors, 14913
salmon, sockeye, immature in N. Pacific offshore waters, 1956-67, 14633
surfperches, 4-, southern geographical records for, 14816
survey procedure for evaluating trout stream fisheries, 14657
territory conquest by brown trout re initial population density in artificial brook, 14901
^{65}Zn and stable Zn, in experimental marine ecosystem, 14764

Drugs,
actinomycin-D, effect on multiplication of IPN virus, 14615
aminobenzyl penicillin, sensitivity of Aeromonas liquefaciens to, 14837
chloramphenicol, sensitivity of Aeromonas liquefaciens to, 14837
chlortetracycline, sensitivity of Aeromonas liquefaciens to, 14837
fradiomycin, sensitivity of Aeromonas liquefaciens to, 14837
furazolidone,
for control of bacterial hemorrhagic septicemia of carp, 14617
sensitivity of Aeromonas liquefaciens to, 14837
kanamycin, sensitivity of Aeromonas liquefaciens to, 14837
malachite green-formalin mixtures for control of ich, et al., 14706
masoten, determination of metrifonat residue after treating fish for parasitosis, 14889
melatonin, locomotor response to, in juvenile sockeye, 14630
MS-222,
effect on blood sugar and liver glycogen in rainbow trout, 14771
some responses of brown bullhead to, 14708
nifurpirinol,
(P-7138), against bacterial fish pathogens, in vitro, 14705
sensitivity of Aeromonas liquefaciens to, 14837
nitrofurazone, sensitivity of Aeromonas liquefaciens to, 14837
phenylhydrazine-induced anemia in chinook salmon, 14780
pituitary injection in propagation of grass- and silver carp, 14865
quinaldine sulfate, efficacy and residues re striped bass anesthesia, 14680
serotonin, locomotor response to, in juvenile sockeye, 14630
streptomycin, sensitivity of Aeromonas liquefaciens to, 14837

Drugs, cont.
sulfamonomethoxine, sensitivity of Aeromonas liquefaciens to, 14837
sulfisoxazole, sensitivity of Aeromonas liquefaciens to, 14837
tetracycline, sensitivity of Aeromonas liquefaciens to, 14837

Ecology,
bacteria associated with surface of stream-incubating Pacific salmon eggs, 14601
community metabolism in Bay of Quinte and Lake Ontario, 14755
ecosystem,
alteration by mosquitofish predation, 14869
experimental-, marine-, distribution of ^{65}Zn and stable Zn, 14764
fishery interaction in a body of water, modelling of, 14864
effects of heated waste waters on some microorganisms, 14773
environmental,
control of teleost reproduction, 14789
factors re distribution of pikeperch and roach in Sea of Azov, 14913
habitat preferences of harlequin darter in Texas, Oklahoma, 14750
herring, blueback, salinity tolerance of young, 14739
logging and road construction, effects on North California streams, 14725
macroinvertebrates, Bay of Quinte and Lake Ontario, associations and species, 14753
mercury,
accumulation in food chains, 14861
occurrence and effects in ecosystem, 14900
microorganisms growing on peled spawn, 14776
of silverjaw minnow, 14876
pesticide,
effects on non-target species, 14717
residues of 20 Mississippi delta lakes, 14675
road salt as polluting element, 14722
submerged environment of Fla., its future re dredging, filling, public trust, 14674
trout streams, 4, in Normandy, 14904
weed control and herbicides, toxicological effects on fish and other organisms, 14583

Economics,
cost of 2 strains of trout stocked in California lake, 14819
fish production in Arkansas in 1969 vs. other states, 14677

Electricity,
electrofishing effects on invertebrates of English stream, 14907

Embryology,
carp from adhesive and degummed eggs, comparative evaluation of, 14921
nitrogenous metabolites of fish eggs and larvae, 14872
preparing teleost embryos for study, 14712
salmon, Pacific, bacteria associated with surface of stream-incubating eggs, 14601
shell membrane of fish egg, amino acid composition and solubilization of, 14636
zinc localization in carp spawn, embryos and larvae, 14775

Equipment,
cage, rotable, for high-density aquaculture, 14701
circulating seawater system for studies with crabs, 14716
dispenser for Winkler's dissolved oxygen reagents, 14770
electrodes, underwater-, for electrocardiography of eel, 14832
feeder, fish-, battery-powered-, automatic-, for use in remote areas, 14658
girthometer, fish-, for field use, 14619
hydrofoils, removable, for surface and bottom sampling with one otter trawl, 14686

Equipment, cont.
incubator, pelagic-egg-, for use on ships, 14920
monopolar lead of electrocardiograms from body surface of eel, 14831
net-board for setting beach seines from small boats, 14774
plankton splitter, modified-, Folsom-, for analysis of meter net samples, 14660
rotating closed vessels for determining oxygen consumption by fish eggs, 14873
sampler, Kajak-, bottom-, new model, plus sampling techniques re zoobenthos, 14822
screen, traveling, for removal of debris from rivers, 14772
separator, for quantitative count of meiobenthos, 14927
tank, environmental-control-, for study of salmon growth and metabolism, 14825

Estuaries,
Dnieper-Bug, reproduction of Black Sea pikeperch in, 14931
Great South Bay, N. Y., comparison of shore-zone fishes over different bottoms, 14613
Monterey Bay, predation on salmon by sea lions, 14817
pesticides and PCB's in, 14586
White Oak River-, N. C., description of young menhaden in, 14651

Fertilization,
Great Central Lake,
effect on,
juvenile sockeye, 14647
primary production, 14646
stock of zooplankton after fertilization, 14648
lime for fish-breeding ponds, 14926
nitrate and phosphate addition re eutrophication of experimental lake, Canada, 14762

Food habits,
bass, largemouth, exploitation of crayfish in Ohio pond, 14714
bighead, 14738
bowfin, in eastern Texas, 14723
buffalo,
bigmouth, from 4 Oklahoma reservoirs, 14689
smallmouth, from 4 Oklahoma reservoirs, 14689
carp,
grass, in Russian farm ponds, 14737
in 5 Oklahoma reservoirs, 14662
silver, 14738, 14740
young-, ^{14}C for determination of food consumption, 14744
catfish,
channel, and feeding chronology in Conowingo Reservoir, 14663
flathead, adult, in Oklahoma reservoirs, 14665
crappie, white, adult-, in Conowingo Reservoir by season, 14877
feeding,
frequency for a maximum daily ration, re 6 fishes, 14836
selective-, of aquatic organisms, model of, 14928
flounder, winter, surges into intertidal zone, 14757
gar,
Florida, from 5 central Florida lakes, 14667
in eastern Texas, 14723
longnose, from 5 central Florida lakes, 14667
phytophagous fishes, role of infusoria in food of larvae, 14871
pike, northern, in Kremenchug Reservoir, USSR, 14929
piscivorous fishes in Lake Michigan, utilization of alewives, 14730
ration size and digestion in largemouth bass, 14805

Food habits, cont.
salmon,
chinook, juvenile in Columbia River re thermal pollution, 14721
juvenile-, size re their prey, 14824
Pacific-, in Bering Sea, summer of 1966, 14827

Genetics,
allelic isozyme synthesis, preferential inhibition of, in sunfish hybrid, 14886
cyprinid hybrid (Notropis pilsbryi X Chrosomus erythrogaster), new, from Oklahoma, 14782
esterases, tissue-, of crappies, comparison by electrophoresis and selective inhibitors, 14799
karyotypic analysis of 2 sympatric killifishes, 14785
multiple cistrons for LDH and MDH and achromatic bands in round whitefish, 14885
polymorphism, albumin-, in white perch, 14891
subpopulations of Hawaiian striped mullet, variations of nuclear eye-lens proteins and - weights, 14794
sucker, white- and longnose-, biochemical and cytological study of large and dwarf forms, 14759
tetraploid origin of the karyotype of catostomids, 14868
variability of buffalofishes in Arizona, 14749

Habitat improvement,
carp,
grass, weed control in India, 14745
silver, in Russian ponds, 14740
rapids, artificial, re creation of food supply for trout in Carpathian mountains, 14930
sediment in Michigan trout stream: source, movement and effects, 14589

Harvest,
bass, striped, winter gill-net catches in Rappahannock River, 14690
Bureau of Commercial Fisheries Report for 1969, 14614
creel,
and use history, 16-yr-, of Noontootla Creek under changing regulations, 14687
survey of Oklahoma lakes re improvement of creel survey design, 14679
sport fishery for silver redhorse in Flint River, Alabama, 14683
trap nets, Wisconsin-type-, 10-ft, relationship between lifts and catch of, 14678
trout,
brown, biology re commercial size in Karelian lakes, 14912
rainbow, 2 domestic strains stocked in California lake, 14819
steelhead, winter fishery on No. Fork of Stillaguamish River, 14727

Identification,
Chironomidae of South Dakota, 14655
classification of living fishes, modern concepts of, 14910
cyprinid hybrid (Notropis pilsbryi X Chrosomus erythrogaster), new, from Oklahoma, 14782
dimorphism, sexual, re chromatin patterns in fishes, 14625
Notemigonus biguttatus species group, 14643
perch, white, albumin polymorphism in, 14891
sunfish, hybrid, allelic isozyme synthesis, preferential inhibition of, 14886
tuna, larval-, particularly Thunnus, 14645
whitefish, round, multiple cistrons for LDH and MDH and achromatic bands, 14885

In Vitro,
studies of nifurpirinol (P-7138) against bacterial fish pathogens, 14705

Lake,
Arakum lakes, USSR, resorption of gonads of fish re lake discharge regulation, 14918
cage culture of channel catfish, 14676
central Florida, 5 lakes, food habits of gars in, 14667
Clear-, Texas, Henneguya texana n. sp. from darter, 14811
Great Central,
effect of fertilization on primary production, 14646
stock of zooplankton after fertilization, 14648
Great Lakes, concentrations of DDT and dieldrin in fish, 14796
Issyk-Kul', temperature re spermatozoan speed and fertilizing capacity, 14867
Michigan, utilization of alewives by piscivorous fishes, 14730
Okeechobee, Fla., vegetational changes re water level stabilization, 14661
Ontario,
associations and species of benthic macroinvertebrates, 14753
benthic community metabolism, 14755
production of benthic macroinvertebrates, 14754
Ouachita, Ark., predation on rainbow trout by bass and pickerel, 14666
reservoir,
Clark Hill, S. C., life history of bass, striped X white, 14668
Conowingo,
feeding by channel catfish, 14663
seasonal food habits of adult white crappie, 14877
cooling-, stocked with herbivorous fishes, USSR, 14741
Dnieper, phenol- and thiocyanate-decomposing bacteria re natural purification of, 14925
Hartwell, S. C., life history of bass, striped X white, 14668
Keystone, Okla.,
life history of striped bass, 14672
species of net zooplankton and physiochemical conditions, 14752
Kremenchug, ration of northern pike in, 14929
Kuibyshev, flow regulation of Volga re fishes in, 14866
Lake Russell, Ga., comparison of sampling results with total fish population in, 14659
Lake Sinclair, Ga., thermal pollution re temperature and oxygen levels in, 14664
Oklahoma-,
feeding by flathead catfish in, 14665
food habits of carp in, 14662
Wanapum Dam-, effect on salmon passage over Columbia River dam, 14653
Salton Sea, ovarian cycling in longjaw gobies from, 14813
Texoma, early life history of gars, 14756
Yellowstone, ultrasonic tracking and tagging studies of homing cutthroat, 14729

Life history,
bass, striped,
in Keystone Reservoir, Oklahoma, 14672
X white, in 2 So. Carolina reservoirs, 14668
young, of inland Florida, 14671
darter, eastern, Johnny, in cold tailwater and sewage-polluted water, 14731
perch, sand, northern Gulf of Mexico, 14641
salmon,
coho, of Karluk River system, Alaska, 14649
masu, off western Kamchatka, 14826
sturgeon stocks of Caspian Sea, propagation based on biology, 14914

Limnology,
community metabolism in Bay of Quinte and Lake Ontario, 14755
effects of heated waste waters on some microorganisms, 14773

Limnology, cont.
eutrophic,
alkaline waters of Nebraska, survey of fishes in, 14769
reservoir, continuous system models of oxygen depletion in, 14751
eutrophication of experimental lake by addition of nitrate and phosphate, Canada, 14762
limnologists, fishery-, world list of, 14628
macroinvertebrates, Bay of Quinte and Lake Ontario, 14753, 14754
mercuric sulfide, mobilization from sediment into fish under aerobic conditions, 14766
microorganisms growing on peled spawn, 14776
plankton, net-, seasonal cycles in cold-tailwater and natural stream, Ark., 14685
re Cs-137 uptake by fish, 14698
reservoirs, fatty alcohols used to reduce surface evaporation, effects on organisms, 14777
sediment in Mich. trout stream: source, movement and effects, 14589
species of zooplankton and physiochemical conditions in Keystone Reservoir, Oklahoma, 14752

Management,
action report, conservation and enhancement of fish and wildlife in national water resources program, 14909
Bureau of Commercial Fisheries Report for 1969, 14614
creel and use history, 16-yr-, of Noontootla Creek under changing regulations, 14687
Oklahoma State Lake Creel Survey re improvement of creel survey design, 14679
sturgeon stocks of Caspian Sea, propagation based on biology, 14914
submerged environment of Fla., its future re dredging, filling, public trust, 14674
sunfish control, improved methods of treating ponds with antimycin A, 14673
survey procedure for evaluating trout stream fisheries, 14657
trap nets, Wisconsin-type-, 10-ft, relationship between lifts and catch of, 14678
trout,
brown, biology re commercial size in Karelian lakes, 14912
in Carpathian mountains, artificial rapids for creation of food supply, 14930
weed control and herbicides, toxicological effects on fish and other organisms, 14583

Marking,
evaluation of several marks on channel catfish, 14656
fluorescent pigments, survival and mark retention of cyprinid, 14724
tag, small-, sonic-, for measuring fish locomotor behavior, 14784

Mathematics,
biostatistical method of population analysis, Derzhavin's-, 14612
feeding frequency for a maximum daily ration, re 6 fishes, 14836
metabolism, community-, in Bay of Quinte and Lake Ontario, 14755
model of,
selective feeding of aquatic organisms, 14928
vertical distribution and production of phytoplankton, 14924
modeling of interaction between fishery and ecosystem of a body of water, 14864
models, continuous-system-, of oxygen depletion in eutrophic reservoir, 14751
production of benthos in Bay of Quinte and Lake Ontario, 14754
relation between production and biomass, 14604
relationship between lifts and catch of 10-ft, Wisconsin-type, trap nets, 14678
standard error of LC_{50} and sample size in fish bioassays, 14880
simulation studies of Adams River sockeye, 14599

Migration and movement,
carp, grass, tolerance to seawater, 14746
fish movements from Okefenokee Swamp into Suwanee River, 14684
flounder parasites as biological tags, 14781
homing cutthroat in Yellowstone Lake, ultrasonic tracking and tagging studies of, 14729
lamprey, river, effects of gonadectomy on osmoregulation during, 14809
salmon,
masu, off western Kamchatka, 14826
Pacific, effect of reservoir on passage over Columbia River dam, 14653
sockeye, immature, in No. Pacific offshore waters, 1956-67, 14633
semi-migratory fishes of Don River, USSR, factors affecting abundance, 14911
surges of winter flounder into intertidal zone, 14757
swimming ability of fed and starved larval largemouth bass, 14786

Parasites,
Bomocholidae, 4-, from fishes of British Columbia, 14603
Ceratomyxa shasta, control by treating hatchery water supplies, 14703
Diphyllobothrium spp., occurrence in Alaska, 14629
flounder-, as biological tags, 14781
helminth-, in some fishes of eastern Texas, 14790
Henneguya texana, n. sp. from black drum, Clear Lake, Texas, 14811
Ichthyophthirius and other protozoans, control with malachite green-formalin mixtures, 14706
Rhabdochona, in fishes of North and Central America, 14606

Physical factors,
flow regulation of Volga re reproduction of Kuibyshev Reservoir fishes, 14866
Keystone Reservoir, Okla., and species of net zooplankton, 14752
photobarogradient chamber, orientation of young freshwater fishes in, 14874
regulation of lake discharge, USSR, re resorption of gonads in fishes, 14918
temperature,
and,
dietary lipids re growth, metabolism and composition of catfish, 14892
swimming speed re oxygen consumption of bass, 14627
differences in heat resistance of sperm of Pacific salmon, 14916
effect on toxicity of zinc to bluegill, 14906
effects on early development of herring, 14602
high-, lethal-, of golden shiner, 14748
re,
growth, food conversion, and body composition of channel catfish, 14733
intermediary metabolism in eels, 14883
speed and fertilizing capacity of spermatozoa of Issyk-Kul' fishes, 14867
selection of rainbow trout fingerlings, vertically and horizontally, 14765

Physiology,
ACTH cells in pituitaries of freshwater teleosts, histology of, 14848
adenosine 5'-monophosphate, degradation in rainbow trout liver, 14847
albumin polymorphism in white perch, 14891
aldolase, muscle-, in trout, properties and amino acid composition, 14820
alkaline RNA-hydrolyzing enzyme in pyloric caeca of rainbow trout, 14854
allelic isozyme synthesis, preferential inhibition of, in sunfish hybrid, 14886
amino acid composition and solubilization of fish egg shell membrane, 14636
anaerobic endproducts of freshwater fish exposed to hypoxia, 14881
anemia, phenylhydrazine-induced-, in chinook salmon, 14780
anoxia and Na loss in death of brook trout at low pH, 14810
argyrophil adenohypophysial- and other cells in trout demonstrated via new technique, 14635
auto-antibodies, epithelial-, failure to detect in sera of fish with UDN, 14783
biochemical and cytological study of large and dwarf longnose- and white suckers, 14759

Physiology, cont.
blood,
chemistry and respiration in marine and freshwater eels, 14709
composition of stickleback with adverse oxygen regime, 14915
glucose, effects of starvation and diet on, in carp, 14849
sample preservation for hemoglobin assay, 14711
volume determination in fish, an approach, 14597
body,
compartmentalization and ion distribution in perch, 14808
composition, food conversion and growth of catfish re feeding rates and temperature, 14733
carbohydrases in digestive organs of several fishes, 14841
carotenoids in eggs of sterlet from Danube, 14792
chloride transport by rainbow trout gills, 14779
chromatin patterns in fishes re sexual dimorphism, 14625
circulatory and ventilatory responses of rainbow trout to gill surface area change, 14609
DDT in 8 California marine fishes, 14815
digestibility of sunflower, lupin, rye and food mixture by yearling carp, 14863
digestible and indigestible food fractions, differential movement of, in rainbow trout, 14768
digestion
and ration size in largemouth bass, 14805
rate of larval largemouth bass, 14607
electrocardiography of eel via underwater electrode, 14832
enzyme (LDH and GOT) activity in white sucker blood plasma re metal cations et al., 14640
enzymes,
MFO-, re aldrin epoxidation and parathion activation in fishes, 14898
proteolytic-, in salmon caeca, behavior in gel chromatography, 14823
epiphysis cerebri of fish, slow potential from, 14844
erythropoiesis thru clone cell formation in peripheral blood of white sucker, 14626
esterases, tissue-, of crappies, comparison by electrophoresis and inhibitors, 14799
fecundity of largemouth bass receiving artificial food, 14681
flicker-ERG in rainbow trout, funa and eel, 14857
glucose-6-^{14}C metabolism in carp, effect of diet on, 14850
gonad resorption in fishes re regulation of lake discharge, USSR, 14918
hepatopancreatic glycogen, effects of starvation and diet on, in carp, 14849
histochemical and cytophotometric assay of acid stress in fish, 14908
iodide, seasonal changes in extra-thyroidal distribution in burbot, 14801
lateral-line,
sense organs, fine structure of, in dogfish, 14879
system of fishes, nervous connections between neuromasts of, 14616
lipid content,
and fatty acid composition of masu salmon at smolt change, influence of light, 14828
effect of starvation and diet on, in carp, 14849
of plasma, liver and viscera in mature and immature female trout, 14840
lipids, conjugated-, of red salmon kidney, 14829
locomotion, fish-, large-amplitude elongated body, theory of, 14878
melatonin, locomotor response to, in juvenile sockeye, 14630
mercuric sulfide, mobilization from sediment into fish under aerobic conditions, 14766
mercury,
content in Myoxocephalus in Finland, 14818
determination,
of traces by atomic absorption spectrometry, 14719
rapid-, in fish, 14618
semi-automated-, in fish tissue, 14590

Physiology, cont.
mercury, cont.
in fish and birds near polluting industries in Canada, 14593
levels in fish from Wisconsin waters, 14585
organic-, determination in fish by emission spectrometry, 14620
metabolism,
composition and growth of catfish re temperature and dietary lipids, 14892
intermediary, in eels, effects of temperature and feeding on, 14883
microhaematocrit values re haemoglobin concentrations and erythrocyte numbers in carp, brook trout, 14788
midgut of Salmonidae, comparative histology of, 14919
MS-222, effect on blood sugar and liver glycogen in rainbow trout, 14771
multiple cistrons for LDH and MDH and achromatic bands in round whitefish, 14885
nerve, lateral-line-, in trout, recording electrical activity of, 14715
nitrogenous metabolites of fish eggs and larvae, 14872
nuclear eye-lens protein variations in subpopulations of Hawaiian striped mullet, 14794
nucleotides, post-mortem degradation of, in trout liver, 14842
olfactory function of Atlantic salmon, effect of synthetic surfactants on, 14896
osmoregulation, effects of gonadectomy on, in migrating river lamprey, 14809
ovarian cycling in longjaw gobies from Salton Sea, 14813
oxygen,
consumption of,
bass re swimming speed and temperature, 14627
fish eggs, use of rotating closed vessels for determination of, 14873
dissolved, minimum required for normal fish life, 14838
equilibrium of trout hemoglobin, 14694
requirements of larvae of blenny, goby, skilletfish, 14890
pesticide residue analysis, dry ice homogenization for fish samples in, 14718
pesticides, chlorinated-, gas chromatography-mass spectrometry of residues in foods, 14622
phosphorylation sites in protamine biosynthesis in trout, 14778
proteinase,
mackerel-,
hydrolysis reaction of Nα-benzoyl-L-arginine-amide catalyzed by, 14859
substrate specificity of, 14851
properties from pyloric caeca of mackerel, 14833
purine content, seasonal change of, in masu salmon skin from parr to smolt, 14846
quinaldine sulfate, efficacy and residues re striped bass anesthesia, 14680
respiration,
aerial, of young gars, social aspects, 14791
influence of branchial resection on, in carp, 14839
respiratory,
effect and metabolite concentrations of 2, 4-dinitrophenol in herring embryos, 14795
movements of fish, comparison of methods for measuring, 14884
responses of brown bullhead to MS-222, 14708
ribonuclease, purification and properties of, from pink salmon liver, 14800
ribonucleotide reductase in immature salmon testes, 14608
rotatory-flow technique for detecting sublethal poisoning of fish, 14860
sensory factors in positioning of schooling tuna, 14654
serotonin, locomotor response to, in juvenile sockeye, 14630
slimes, fish-, fluid friction of, 14691
sperm, differences of heat resistance of, in salmon, 14916
spermatozoa of Issyk-Kul' fishes, temperature re speed and fertilizing capacity of, 14867
starvation, prolonged, response of young sockeye to, 14761
swimming ability of fed and starved larval largemouth bass, 14786
thiols of proteins, radiochromatographic assay for, using labeled mercury, 14621

Physiology, cont.
thyroid function and dermal purines in brook trout, 14803
tissues, perch-, extracellular spaces and composition of, 14807
tritium in fish embryo and larva and radiation effect, 14695
urea excretion by fish re concentration of ambient ammonia, 14882
vitamin requirements, minimum-, for carp, 14834
zinc localization in carp spawn, embryos, larvae, 14775

Plankton,
net-, seasonal cycles in cold tailwater and natural stream in Arkansas, 14685
phyto-,
eaten by silver carp in Russian ponds, 14740
mathematical model of vertical distribution and production of, 14924
zoo-,
net-, species and physiochemical conditions in Keystone Res., Okla., 14752
stock in fertilized Great Central Lake, 14648

Pollution,
acid-, histochemical and cytophotometric assay of stress in fish, 14908
alcohols, fatty, for reduction of evaporation from reservoirs, effects on aquatic organisms, 14777
chlorine,
residuals, toxicity to freshwater fish, 14875
toxicity to brown trout, 14642
DDT,
concentrations in Great Lakes fish, 14796
in 8 California marine fishes, 14815
separated from PCB's on silica gel, 14584
dieldrin, concentrations in Great Lakes fish, 14796
2,4-dinitrophenol, effect on respiration, plus metabolites, in herring embryos, 14795
logging and road construction, effects on No. California streams, 14725
mercuric sulfide, mobilization from sediment into fish under aerobic conditions, 14766
mercury,
accumulation in food chains, 14861
content in Myoxocephalus in Finland, 14818
determination of traces by atomic absorption spectrometry, 14719
in fish and birds near polluting industries in Canada, 14593
levels in fish from Wisconsin waters, 14585
occurrence and effects in ecosystem, 14900
metal cations and chemicals re LDH and GOT activity in white sucker blood plasma, 14640
PCB's, chromatography-spectrometry characterization of, plus ^{36}Cl-labeling, 14887
pesticides,
in estuaries, 14586
residues of 20 Mississippi delta lakes, 14675
phenol- and thiocyanate-decomposing bacteria re natural purification of Dnieper reservoirs, 14925
PMA, number of eggs and young from zebrafish in water containing, 14639
poisoning, sub-lethal-, rotatory-flow technique for detection in fish, 14860
poisons, PCB's in estuaries, 14586
pollutants of fresh water, correlation of structure vs. activity, 14905
road salt as a polluting element, 14722
salmonid-hatchery wastes, evaluation of, 14720
sewage-polluted water vs. cold tailwater re life history of darter, 14731
surfactants, synthetic, effect on olfactory function of Atlantic salmon, 14896

Pollution, cont.
thermal-,
effect on some microorganisms, 14773
high lethal temperatures of golden shiner, 14748
of Columbia River, threat to smelt, 14591
re feeding of juvenile chinook in Columbia River, 14721
re morphology of bream, 14922
re temperature and oxygen levels in Lake Sinclair, Georgia, 14664
toxicological assays with fish, 14592
urea-derivative herbicides, chronic effects on fish and their food, 14932
zinc toxicity to bluegill, effects of pH, solubility and temperature, 14906

Populations,
analysis, Derzhavin's biostatistical method of, 14612
buffalofishes in Arizona, variability of, 14749
comparison of sampling results with total fish population in Lake Russell, Georgia, 14659
density,
age and growth of barbel and grayling in Ourthe River, 14902
initial-, re territory conquest by brown trout in artificial brook, 14901
Nocomis biguttatus species group, 14643
perch,
European, rate at which it populates lakes, 14917
structure in some ponds of Finland, 14821
salmonid-, of Lough Erne waters, recruitment re UDN, 14787
simulation studies of Adams River sockeye, 14599
sub-, of Hawaiian striped mullet, variations of nuclear eye-lens proteins and -weights, 14794
tuna, yellowfin, mortality estimates in E. Pacific via tagging, 14632

Predation,
bass, largemouth, on rainbow trout in Lake Ouachita, Arkansas, 14666
mosquitofish-, re alteration of ecosystem, 14869
pickerel, chain, on rainbow trout in Lake Ouachita, Arkansas, 14666
piscivorous fishes in Lake Michigan, utilization of alewives, 14730
sea lions on salmon in Monterey Bay, 14817
size-selective-, among juvenile salmonids in British Columbia inlet, 14600
visual mechanism determining flight distance in zebra danio, 14899

Production,
benthic macroinvertebrates in Bay of Quinte and Lake Ontario, 14754
fish-, in Arkansas in 1969 vs. other states, 14677
phytoplankton-, mathematical model of, 14924
primary, effect of fertilization on, in Great Central Lake, 14646
relation with biomass, 14604

Radiobiology,
acoustic conditioning for induced aggregation of pond-reared rainbow trout, 14728
^{14}C for determination of food consumption of young silver carp, 14744
^{36}Cl-labeling of PCB's, 14887
^{137}Cs, uptake by fish, effect of limnological factors, 14698
emission spectrometry for determination of organic mercury in fish, 14620
glucose-6-^{14}C metabolism in carp, effect of diet on, 14850
^{3}H-thymidine for study of erythropoiesis thru clone cell formation in white sucker blood, 14626
radiochromatographic assay for thiols of proteins using labeled mercury, 14621
radionuclides retention by Atlantic croaker, 14588
sonic tag, small, for measuring fish locomotor behavior, 14784
tritium in fish embryo and larva and radiation effect, 14695

Radiobiology, cont.
ultrasonic tracking and tagging studies of homing cutthroat trout in Yellowstone Lake, 14729
^{65}Zn,
and stable Zn, distribution in experimental marine ecosystem, 14764
cycling in a simple food web, 14696

Reproduction,
breeding habits of 2 subspecies of longnose dace, 14804
fecundity of,
largemouth bass receiving artificial food, 14681
rosyside dace, 14894
fishes of Kuibyshev Reservoir, effect of regulation of Volga flow, 14866
lamprey, American, brook, pre-spawning characteristics, Big Creek, Canada, 14595
mate selection in pumpkinseed and longear sunfish, 14802
nest-digging behavior of rainbow trout, 14631
omul, Baikal-, survival of eggs in Kichera River re flow, 14870
ovarian cycling in longjaw gobies from Salton Sea, 14813
pikeperch, Black Sea, in Dnieper-Bug estuary, 14931
propagation of,
Caspian sturgeons based on their biology, 14914
grass- and silver carp via pituitary injection, 14865
spawning,
and rearing of grass carp in Arkansas, 14682
behavior of silver redhorse in Flint River, Alabama, 14683
induced, of gilthead, Italy, 14888
teleost-, environmental control of, 14789
zebrafish, number of eggs and young produced in water containing PMA, 14639

Research,
acid stress in fish, histochemical and cytophotometric assay of, 14908
action report, conservation and enhancement of fish and wildlife in national water resources program, 14909
antimycin, half-life of biological activity via fish bioassay, 14734
antimycin A, improved method of treating ponds for sunfish control, 14673
bioassays, fish-, standard error of LC_{50} and sample size in, 14880
Bureau of Commercial Fisheries Report for 1969, 14614
carp, grass,
sensitivity to fish toxicants, 14707
weed control in India, 14745
channel catfish virus, at Auburn Univ., Alabama, 14797
DDT separated from PCB's on silica gel, 14584
eutrophication of experimental lake by nitrate and phosphate addition, Canada, 14672
herbivorous fish in USSR, 14742
huratoxin piscicide, isolation and characterization, 14637
masoten, determination of metrifonat residue after treating fish for parasitosis, 14889
mercury determination,
of traces by atomic absorption spectrometry, 14719
organic-, in fish by emission spectrometry, 14620
rapid-, in fish, 14618
semi-automated-, in fish tissue, 14590
MFO activity in freshwater fishes: aldrin epoxidation and parathion activation, 14898
PCB's chromatography-spectrometry characterization of, plus ^{36}Cl-labeling, 14887
pesticide residues, chlorinated-, chromatography-mass spectrometry of, in foods, 14622
pesticides, dry ice homogenization for fish samples in residue analysis, 14718

Research, cont.
pollutants of fresh water, correlation of structure vs. activity, 14905
quinaldine sulfate, efficacy and residues re striped bass anesthesia, 14680
radiochromatographic assay for thiols of proteins using labeled mercury, 14621
tank, environmental-control-, for salmon growth and metabolism study, 14825
toxicological assays with fish, 14592
Zn toxicity to bluegill, effects of pH, solubility and temperature, 14906

River,
Adams, simulation studies of sockeye, 14599
Columbia,
effect of Wanapum Dam Reservoir on salmon passage over Rock Island Dam, 14653
feeding of juvenile chinook re thermal pollution, 14721
thermal pollution of, threat to smelt, 14591
Danube, carotenoids in sterlet eggs from, 14792
Don, factors affecting abundance of semi-migratory fishes, 14911
Flint, Ala., spawning behavior, age and growth, and sport fishery for silver redhorse, 14683
Karluk-, system, life history of coho salmon, 14649
Kichera, survival of Baikal omul eggs re flow, 14870
Noontootla Creek, 16-yr creel and use history of trout stream under changing regulations, 14687
Ourthe, population density, age and growth of barbel and grayling in, 14902
Rappahannock, age composition and magnitude of striped bass winter gill-net catches, 14690
Stillaguamish, Wash., N. Fork, evaluation of winter steelhead fishery, 14727
Suwanee, fish movements from Okefenokee Swamp into, 14684
Volga, flow regulation re reproduction of Kuibyshev Reservoir fishes, 14866

Sampling,
bottom- and surface-, with single otter trawl via removable hydrofoils, 14686
electrofishing, effects on invertebrates of English stream, 14907

Specific,
alewife, 14730
asp, 14866
ayu, 14844
bairdiella, 14814
balloonfish, 14767
barbel, 14902
bass,
largemouth, 14607, 14627, 14666, 14681, 14714, 14786, 14805, 14899
smallmouth, 14730
striped, 14669, 14671, 14672, 14680, 14690
striped X white, 14668
bighead, 14736, 14738, 14871
bleak, 14866
blenny, striped, 14890
bluegill, 14704, 14722, 14881, 14906
bowfin, 14684, 14723, 14730
bream,
European, 14918, 14922
red, sea, 14835
white, 14866

Specific, cont.
buffalo,
bigmouth, 14689, 14749
black, 14749
smallmouth, 14689, 14749
bullhead,
black, 14769
brown, 14708, 14881
burbot, 14730, 14801
carp, 14596, 14617, 14662, 14696, 14700, 14736, 14737, 14743, 14775, 14788, 14834, 14838, 14839, 14841, 14849, 14850, 14863, 14918, 14921
grass, 14682, 14707, 14736, 14737, 14741, 14742, 14743, 14745, 14746, 14865, 14871
silver, 14596, 14736, 14738, 14740, 14741, 14744, 14865, 14871
catfish,
channel, 14638, 14656, 14663, 14676, 14688, 14697, 14706, 14733, 14797, 14806, 14812, 14862, 14892, 14893
flathead, 14665
chub, 14889
Coregonus peled, 14776

Specific, cont.
crappie,
black, 14799
white, 14799, 14877
croaker, Atlantic, 14588
dace,
longnose, 14804, 14908
rosyside, 14894
danio, zebra, 14899
darter,
eastern, Johnny, 14731
harlequin, 14750
drum, black, 14811
eel, 14831, 14832, 14838, 14857, 14889
American, 14709, 14883
European, 14904
flounder, winter, 14757
funa, 14857
gar, 14756, 14791
alligator, 14723
Florida, 14667
longnose, 14667, 14723
shortnose, 14723
spotted, 14723
Gillichthys seta, 14767
gilthead, 14888
Gobiosoma paradoxum, 14767
goby, 14836
longjaw, 14813
naked, 14890
goldfish, 14836, 14882
grayling, 14902
herring,
Atlantic, 14795
blueback, 14739
Pacific, 14602, 14699
killifish, striped, 14785
lamprey,
American, brook, 14595
river, 14809
Lebistes reticulatus, 14777
Leuciscus, 14878
lingcod, 14815
mackerel, 14833, 14851, 14859
jack, 14836
menhaden, Atlantic, 14651
minnow,
fathead, 14769, 14875, 14908
sheepshead, 14732
silverjaw, 14876
Monodactylus argenteus, 14798
mosquitofish, 14869
mullet, striped, 14794
mummichog, 14785
Myoxocephalus quadricornis, 14818
Nocomis biguttatus, 14643
Notropis pilsbryi X Chrosomus erythrogaster, 14782
omul, Baikal, 14870

Specific, cont.
perch, 14807, 14808, 14821
European, 14917, 14929
Sacramento, 14769
sand, 14641
shiner, 14816
white, 14891
yellow, 14730
pickerel, chain, 14666
pike, northern, 14730, 14769, 14929
pikeperch,
Black Sea, 14931
European, 14913
Platichthys flesus, 14781
porcupinefish, 14767
pumpkinseed, 14802
rattail, roughscale, 14815
redhorse, silver, 14683
roach,
Azov, 14913
European, 14860, 14918, 14929
rockfish, 14836
sablefish, 14610, 14815
salmon, 14608, 14817, 14852, 14919
Atlantic, 14783, 14895, 14896
chinook, 14650, 14653, 14721, 14758, 14780
chum, 14600, 14601, 14634, 14823, 14824, 14827, 14830
coho, 14600, 14649
masu, 14826, 14828, 14846
Pacific, 14916
pink, 14600, 14601, 14800, 14824, 14827
sockeye, 14599, 14611, 14630, 14633, 14647, 14652, 14653, 14760, 14761, 14827, 14829
sanddab, 14815
sargo, 14814
sculpin, 14904
Scyliorhinus, 14879
seaperch,
rubberlip, 14816
sharpnose, 14816
shiner,
golden, 14748
lake, emerald, 14805
skilletfish, 14890
smelt, rainbow, 14730
sole,
English, 14815
petrale, 14815
sterlet, 14792, 14923
stickleback, ninespine, 14915
sturgeon, 14914
beluga, 14872, 14923
Russian, 14923
spiny, 14872
stellate, 14923

Specific, cont.
sucker, 14868
longnose, 14759
white, 14626, 14640, 14759
sunfish, 14673
green, 14769
longear, 14802
redear, 14886
surfperch, silver, 14816
tench, 14889
tilapia, 14616
trout, 14624, 14657, 14694, 14715
brook, 14693, 14788, 14803, 14810, 14908
brown, 14642, 14881, 14897, 14901, 14903, 14904, 14912
cutthroat, 14729
rainbow, 14609, 14625, 14631, 14635, 14666, 14695, 14703
Specific, cont.
trout, rainbow, cont.
14722, 14726, 14728, 14735, 14758, 14765, 14768, 14771, 14777, 14778, 14779, 14819, 14820, 14836, 14838, 14840, 14842, 14844, 14845, 14847, 14853, 14854, 14857, 14872, 14881, 14882, 14889, 14897
sea, 14872
steelhead, 14727
tuna, 14645, 14654
yellowfin, 14632
walleye, 14700, 14713, 14730
warmouth, 14886
whitefish, round, 14885
yakataisaki, 14836
zebrafish, 14639
zope, 14866

Stocking,
herbivorous fishes in cooling reservoirs in USSR, 14741

Survival,
acid stress in fish, histochemical and cytophotometric assay of, 14908
cyprinid marked with fluorescent pigments, 14724
effect of salinity stress on eggs and larvae of Salton Sea fishes, 14814
eggs, fish, infestation with Leucothrix mucor, 14793
fish,
and their food, chronic effects of urea-derivative herbicides, 14932
death during transportation, bacteriological study concerning, 14835
life, normal-, minimum dissolved oxygen required for, 14838
re low pH and high content of Fe compounds, 14587
semi-migratory-, of Don River, influencing factors, 14911
fishes in alkaline eutrophic waters of Nebraska, 14769
herbivorous fishes,
rearing experience in Czechoslovakia, 14736
stocked in cooling reservoirs, USSR, 14741
larvae of blenny, goby, skilletfish, oxygen requirements of, 14890
omul, Baikal, eggs, in Kichera River re flow, 14870
poisoning, sub-lethal-, rotatory-flow technique for detection in fish, 14860
responses of brown bullhead to MS-222, 14708
salmon, sockeye, response of young to prolonged starvation, 14761
sensitivity of the white amur to fish toxicants, 14707
shiner, golden, high lethal temperatures of, 14748
size-selective predation among juvenile salmonids in British Columbia inlet, 14600
smelt, re threat of thermal pollution of Columbia River, 14591
snails, correlation of structure vs. activity of freshwater pollutants, 14905
tolerance of,
bluegill and rainbow trout to road salt, 14722
young striped bass to 9 pond-culture chemicals, 14669
toxicity of,
chlorine residuals to freshwater fish, 14875
chlorine to brown trout, 14642
2,4-D to fish, 14692
picloram to fish, 14692
zinc to bluegill, effects of pH, solubility and temperature, 14906
toxicological,
assays with fish, 14592
effects of herbicides and weed control on fish et al., 14583

Survival, cont.
trout,
in Finnish lakes treated with rotenone, 14897
rainbow, 2 domestic strains stocked in California lake, 14819
tuna, yellowfin, mortality estimates in E. Pacific via tagging, 14632

Vegetation,
algicides, evaluation of, 14623
changes re water level stabilization in Lake Okeechobee, Florida, 14661
water hyacinth, nutritional value in channel catfish feeds, 14806
weed control and herbicides, toxicological effects on fish and other organisms, 14583
weeds, aquatic, controlled by grass carp in India, 14745

Virology,
channel catfish virus,
a new herpesvirus of ictalurids, 14862
research at Auburn University, Alabama, 14797
tissue distribution of, 14812
IPN,
pathogenicity of isolants from rainbow trout in Japan, 14845
virus,
effect of actinomycin D on multiplication of, 14615
first isolation from epizootics in Japan, 14843
lymphocystis, new records in 4 E. Pacific fishes, 14767
virus-caused epizootic of rainbow trout in Minnesota, 14735

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